ELECTRICAL WORLD

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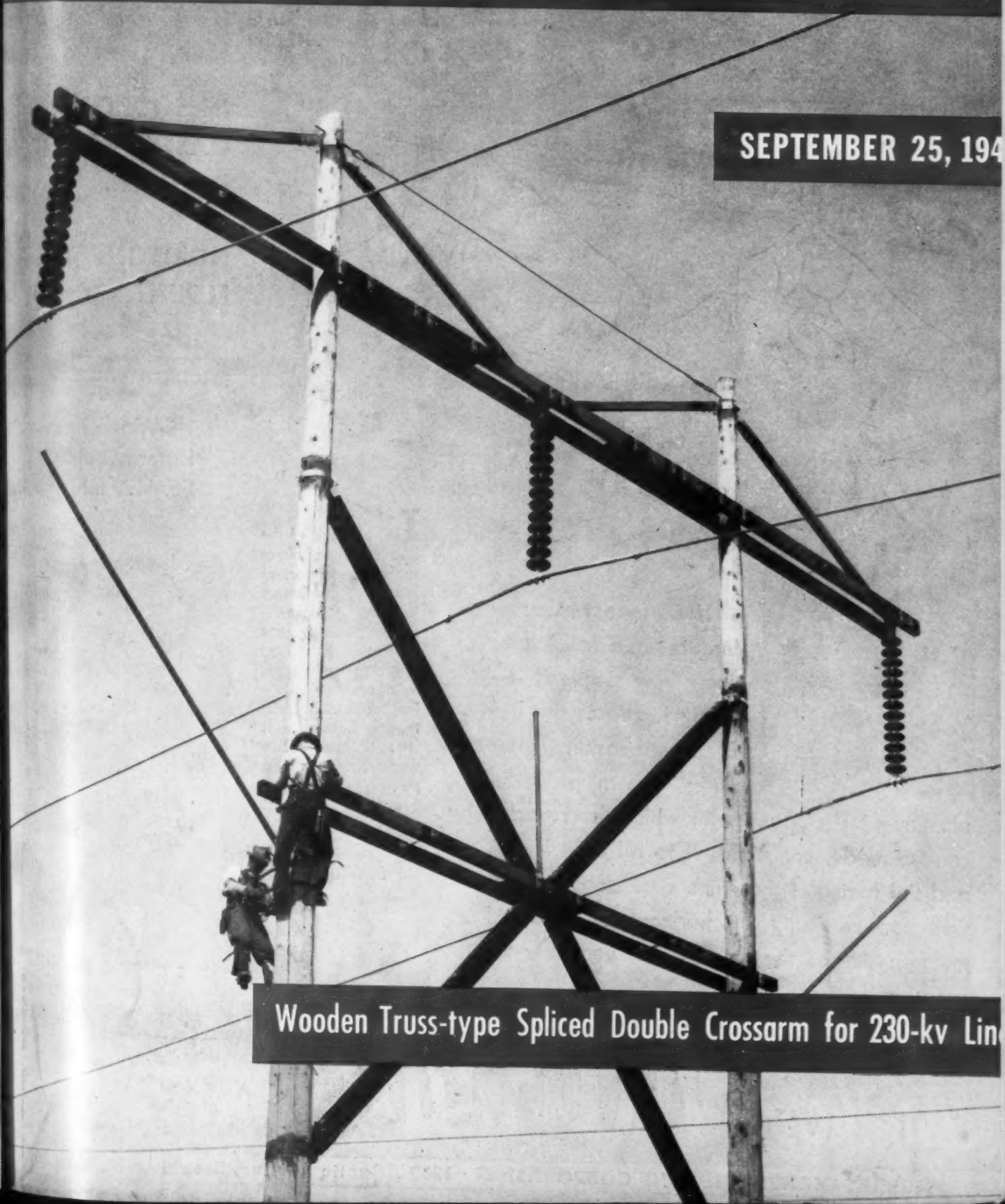

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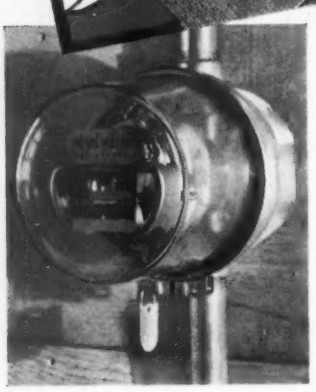

THIS newest Murray feature—and the pictures show how simple it is—vastly increases the use of these socket meter cases, drawn of 3 So aluminum. The speed with which the reversal can be made, commends it to all electricians; and the fact that the same case does equally well for vertically or horizontally mounted meters, reduces the stock which dealers must carry.

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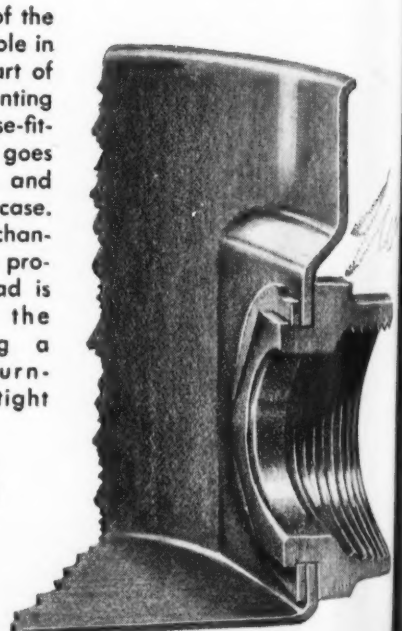

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ELECTRICAL WORLD

Published for 74 years for those engaged in the business of generating, transmitting, distributing or applying electric power

September 25, 1948 **CONTENTS** Vol. 130 No. 13

This Week's Cover Picture

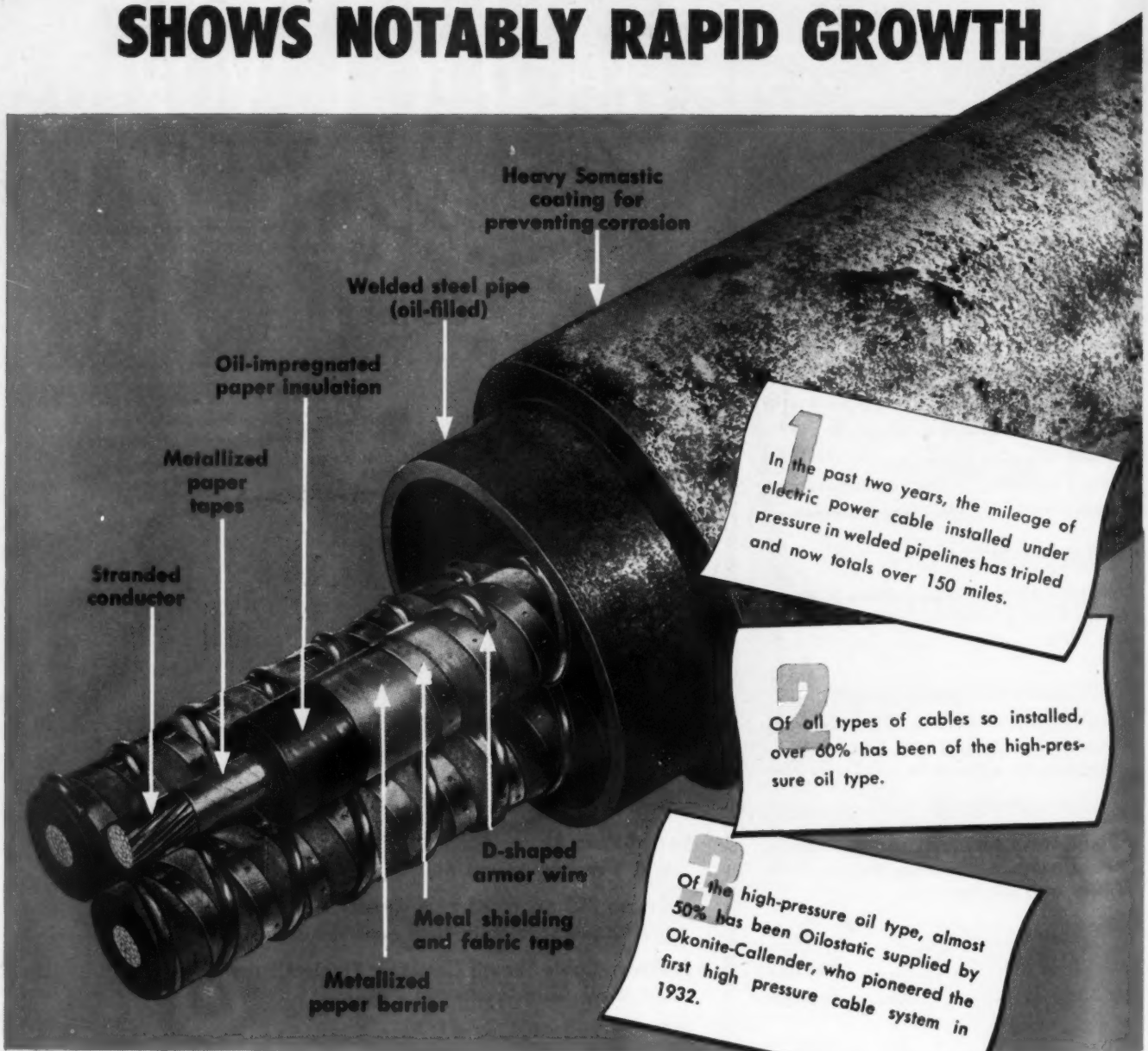
The spliced 46 ft long crossarm for 230-kv Booneville line is constructed of two sets of 30 ft and 16 ft timbers alternately spliced at ends with blocks 6 ft long

Editorials 75
News of the Electrical World 77
Washington Comment 86
Technical Trends 86
Triple-Circuit Line Cuts Lightning Area 87
C. B. Downer, West Penn Power Company
Control Is Centralized At Kern Station 90
The Economics of Subtransmission—II 92
D. K. Blake, C. A. Woodrow and O. B. Falls, Jr.
General Electric Company, Schenectady
Sealed-Beam Lamps For Street Lighting? 97
R. G. Slauer and Willard Allphin
H-Frame 230-Kv Wood Pole Crossarm Design Practice 99
A. A. Osipovich, Bonneville Power Administration
Stubborn Cable Sheath Corrosion Problem Solved 102
L. F. Greve, Commonwealth Edison Company
HOW TO 103
Engineering Reference Sheet 114
Load Building 134
New Equipment 138
More New Products 142
News About People 146
Manufacturers and Markets 150
Recent Rate Changes 153
New Electrical Construction 154
Letters 155
Catalogs and Bulletins 158
Index of Advertisers 162

COMING IN THE OCTOBER 9 ISSUE

Use of Dried Anthracite Silt at Hunlock Extension

ELECTRICAL TRANSMISSION BY PIPELINE SHOWS NOTABLY RAPID GROWTH


Heavy Somastic coating for preventing corrosion
Welded steel pipe (oil-filled)
Oil-impregnated paper insulation
Metallized paper tapes
Stranded conductor
D-shaped armor wire
Metal shielding and fabric tape
Metallized paper barrier
1
In the past two years, the mileage of electric power cable installed under pressure in welded pipelines has tripled and now totals over 150 miles.
2
Of all types of cables so installed, over 60% has been of the high-pressure oil type.
3
Of the high-pressure oil type, almost 50% has been Oilostatic supplied by Okonite-Callender, who pioneered the first high pressure cable system in 1932.

The Oilostatic Transmission System consists essentially of paper-insulated cable installed in a welded steel pipe and maintained in direct contact with oil at 200 psi pressure. The combination of constant saturation and high oil pressure gives Oilostatic cable maximum stability and dielectric strength.

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OKONITE-CALLENDER

OILOSTATIC TRANSMISSION SYSTEMS

ELECTRICAL WORLD *Editorials*

Sept. 25, 1948

A Public Information Department

AN INDUSTRY public information program may be born in the next few months. At least, the stage has been set by the Edison Electric Institute board of directors' approval of a plan for promoting dissemination of public information locally. A tentative budget has been approved and final committee action may be forthcoming in December.

Let's do some wishful thinking and assume that such a program is inaugurated. Who at the local level is currently available and cloaked with sufficient authority to carry out such a program?

Of course you have an advertising department with ample talent in this field; a personnel department with satisfactory personnel policies; and perhaps even a designated public relations executive.

But who, except the president, can coordinate a program locally? Will he have time on top of all other industry problems? We believe he will not.

Now, then, is the time to plan for next year's program in terms of a "Public Information Department." Such a department can probably be formed to a substantial degree out of those now existing.

This is about the minimum requirement for each major utility in the country:

First: A public information executive reporting directly to the president with a title of vice-president and equivalent stature necessary to work on problems national in scope.

Second: A budget adequate to support expanded activities and personnel additions.

Third: Adequate dissemination of information to employees will require—

a. an employee magazine
b. training for employee interpretation of information for the public
c. use of bulletin boards
d. employee meetings
e. attitude surveys

Fourth: Program for dissemination of information to the community will require an organization to provide:

a. programs for local groups
b. cooperation with other organizations
c. contact with radio and press
d. news releases, special articles and publications
e. institutional advertising
f. opinion surveys

Any half way measures will mean failure in the area involved. An uninformed employee can negative an enlightened customer.

Inadequate handling of publicity will place doubts in the minds of the public.

Consistency throughout is the only sure way. That requires a coordinated public information department headed by a responsible executive.

You can't do the job with less.

Pole Treatment, But Which One?

THE NEW *American Standard Specifications and Dimensions for Wood Poles*, just issued, has a strong claim to fame if for no other reason than that it marks the official passing of the chestnut pole. This perennial favorite of the Eastern states, so well remembered for its durability and resistance to the attacks of insects and climbing linemen alike, was driven from the market by the chestnut blight of the '20's. The only excuse for retaining the standard for chestnut poles in late years has been for comparison with surviving chestnuts still in line and new species bought to replace them. Now even that excuse is specious. Still we suspect that it was with some reluctance that committee put the axe to this last old chestnut.

But there are other and forward-looking steps that mark the new pole standard as outstanding. One innovation that will certainly make the new edition easier to use was the inclusion of all pole species in one document, instead of the seven formerly issued.

Also welcomed is the new standard branding system that will make the comparison of species easier under actual service conditions.

The industry will not mourn the passing of the less popular "miscellaneous conifers" of the War Standard. They were given short shrift in the new edition but some of the War Standard species that have proved themselves were given recognition.

However, we view with mixed feelings the statement, in the standard, that poles "are to be given a preservative treatment". This is certainly a step forward. We certainly agree with sectional committee chairman Dr. R. H. Colley in the current issue of ASA's *INDUSTRIAL STANDARDIZATION* that; "The time has long passed for setting untreated poles in utility lines; rather the aim is to get as many years life as possible at the lowest annual cost". The limitation of the standard to poles that are to be treated moves in that direction only one short step. Another important one remains to be taken; to specify treatment. Certainly it is an anomalous situation for an industry standard to suggest pole treatment while at the same time leaving the nature of that treatment unspecified, particularly when pole treatments have become fairly well standardized by practice. Can we not reach agreement on which types of treatment best suit each species and complete the job so well advanced?

For Emergency Use Only

HOT WEATHER of late summer was accompanied by quite a few instances of electric service interruption. Several outages were attributed quite directly to the high temperatures at which equipment had to operate. One in a metropolitan area started with a breakdown of generator-lead insulation, another elsewhere with a substation transformer fuse and so it was.

There was a time when the summer load was so much less than the winter peak that there was little to worry about in the hot weather if the carrying capacity and loadability were good enough for the cold weather demand. Those days are gone for practically all areas. Air conditioning in the South terminated this happy situation a few years back.

Up North, the favorable condition lasted a bit longer but the recent disruptions of service seem to indicate that not enough attention has been given to this matter of seasonal rating. Companies that saw this situation arising proceeded to analyze the seasonal capabilities not only of lines and power transformers, but of disconnect switches, busbar connections, circuit breakers, conductor clamps and splices, fuses, etc. Some rather startling limitations were uncovered and a new program of replacements and reenforcement resulted.

Those who overlooked the consequences of summer thermal limitations have therefore been flirting with danger. If outages were escaped, they should thank their lucky stars and make a resolve for next summer. As the load is now growing, there may be no more margin of capacity then than there is likely to be in December. Of course, if nothing can be done to insure safe reserves, there is available the resort to lowered voltage for shedding load and "having a heart" for the equipment. Not forever, however, can the industry trim the quality of service to meet the demand for quantity. As an emergency, yes, as a habit, no.

April Fooled

HARDLY TWO MONTHS after the British government had taken over the electric utilities, it was announced that the rates would have to be increased. It must have been a jolt to the British consumers after they had been fed the customary pap that "the companies are inefficient and inept and only government can correct matters." Rate **reductions** were promised but the **revisions** are to be the other way. It now develops that the properties were being run at a loss—ordinarily not the result of too high rates.

Vesting day is not turning out to be a good investment day for the Britishers. The whole operation has the earmarks of a headlong dash by a headstrong group to put it over while the going was auspicious. More astute politicians would have delayed the maneuver until the utilities had had to ask higher rates to cover higher costs. Rash action has led quickly to a boomerang. Now no residential or commercial customer will get a kilowatthour for less than 1½ cents if the proposals for escape are instituted.

At least the nationalists cannot be accused of concealing deficits as the public power agencies here are prone to do. When the operation fails to pay its way, the thing to do is admit it and openly rectify the situation. That is what the British board appears to be doing.

NEWS OF THE ELECTRICAL WORLD

The Electrical Week

It didn't take power long to become a lively talking point in the campaign. It isn't news that Truman favors public ownership. But it is when Dewey endorses New Johnsonville and public "mainline" transmission . . . In Cleveland, EEI's directors okayed local public information, but took another look at the proposed national campaign, endorsing it in principle but calling for more study . . . Southeastern Electric Exchange engineers put emphasis on location of cable faults and acceptance of reheat . . . Men and money needed to continue the industry's growth were prime topics at the Rocky Mountain Electrical League's 45th annual convention . . . And in Atlantic City, the International Brotherhood of Electrical Workers, AFL, had some kind thoughts for employers.

With this issue, ELECTRICAL WORLD starts publication of an expanded "Electrical Week." The idea is to get into the paper a line or two from many of the week's news items which ordinarily don't get into print. If you like it, or if you have any ideas on how this service can be made more effective, we'd be glad to hear from you.

Don't look for Tom Dewey to appoint anyone from California, Colorado, or Arizona as Secretary of Interior or Reclamation Commissioner. So high is feeling in those states over the Colorado River water dispute that anyone chosen for such a post must be above suspicion of partiality, for obvious political reasons.

Newspapers get the lion's share of the utilities advertising dollar. A recent survey by PUAA showed this share to be 31.6%. Radio came second with 9.2%.

Probably one and possibly two cable manufacturers will take advantage of the recent court decision on patents covering oil-filled cable. They are expected to take licenses and begin manufacturing.

Coal-railroad-labor lobbyists are busy trying to make friends and influence people at Federal Power Commission these days. They hope to block the New York-Ontario plan to develop St. Lawrence power. So far, they have impressed no one at FPC.

BLS this week issued some figures on 32 industries showing the change in output per man-hour since 1939. The electric light and power industry, with a rise of 67%, was second only to rayon and allied products, which showed a rise of 97%. In third place, far behind, was steam railroad transportation, up 35%.

The ever-increasing cost of fuel has still another eastern utility actively considering the construction of hydro projects it has held undeveloped for years.

Despite this year's increase in its administrative funds, REA is seriously handicapped by inability to hire engineers and other professionals to process loan applications. Chief reasons: Federal pay is too low, and job-seekers feel the agency is sure to have its face lifted by a new administration.

Turbine manufacturers seem to be well recovered from the delaying effects of the 1946 strikes and steel shortages. One manufacturer has asked several utilities if they'd care to take delivery on new units one to two months ahead of schedule. Thus far, all utilities approached have had to turn the offer down. They can't get a comparable speedup in construction work, which is necessary if the earlier deliveries are to mean anything.

While special projectors have been built which will project a television picture on a screen 18x24 ft, a small television receiver, using a 3-in. picture tube will be on the market soon. The picture size will be 4.3 sq in, about the size of an ordinary business card.

Notes from the News:

Switches were pulled in 98 Tokyo substations during the recent strike of a Communist-led electrical workers union in Japan . . . Harry Erlicher, GE's vice-president in charge of purchasing, predicts an economic "change of pace," with somewhat lower prices, "perhaps in 1949" . . . One Canadian builder thinks that the scarcity of concrete in the Dominion is attributable to the construction of so many hydro dams and plants.

National Association of State Chambers of Commerce thinks the Reclamation Bureau is too extravagant in the

printing of all its vast development reports. Particularly, it attacks the Colorado River report and a 335-page job entitled "How Reclamation Pays." . . . U. S. taxes of $313 per capita in 1946 were the world's heaviest, according to the Institute of Life Insurance. Russia's tax burden came next, at $297, and the United Kingdom's third, at $279 . . . Atom Chairman David Lilienthal foresees the threat of "imminent stagnation" for this country's atom program unless the government can command more top-flight scientists, engineers, and managers and can get them right away.

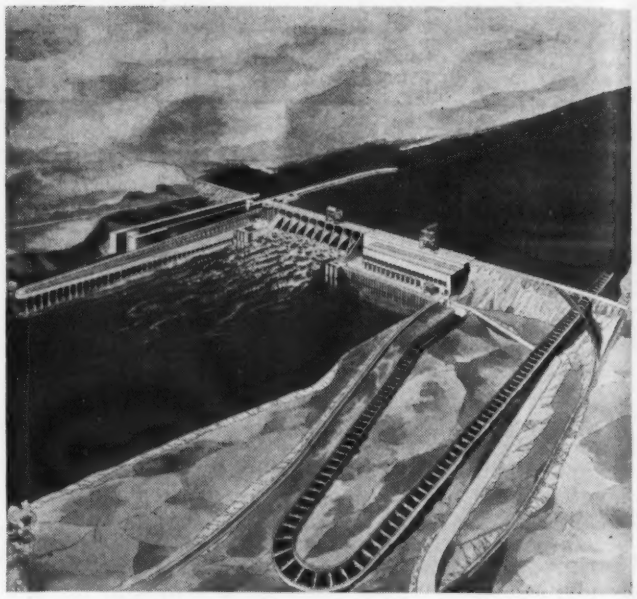
Arizona's Interstate Stream Commission decided to attend the Upper Colorado Basin Compact Commission meeting at Santa Fe Oct 4 . . . Shawinigan Water & Power Co won the Canadian public utility annual report contest for the second consecutive year . . . Guessing as to the total of next year's national budget, which Truman will submit, runs to $45,000,000,000 and higher . . . In June, the average hourly wage in 25 manufacturing industries rose to a new record high of $1.45, according to a National Industrial Conference Board survey . . . Dr. W. C. Schroeder, chief of the Bureau of Mines' Synthetic Liquid Fuels office, believes that by 1953 or '54, domestic demand for oil and gasoline will exceed domestic production from oilwells by 2,000,000 bbl daily.

A CED report shows that the number of small businesses per thousand of population is as large today as at any time in history. Numerically, there's no downward trend in sight, the report adds . . . "The Ontario Hydro doesn't make requests; it gives orders," according to an official of Toronto's Hydro Commission, commenting on a tangle between Niagara Falls, Canada, and Ontario Hydro regarding energy conservation . . . And in Ottawa, officials of three power systems agreed that Ottawa's power shortage has reached the "danger point."

CONSTRUCTION:

Ontario's Hydro-Electric Commission is considering another big steam plant at either Hamilton or Toronto. It would be similar to the 320,000-kw plant now planned for Windsor . . . Tacoma Council has directed its public utilities commissioner to proceed with preliminary cost estimates and design work for the Mayfield project on the Cowlitz. It hopes construction may start this year . . . Houma, La., municipal will increase its system capacity to 6,000 kw by Christmas . . . And preliminary work has begun on the Pine Falls and McArthur Falls projects on Canada's Winnipeg river.

Interior Secretary Krug has recommended construction of the Central Arizona reclamation project. He says estimated benefits will outweigh by 50 to 60% its estimated $738,408,000 cost . . . Despite scarcity of cement, Army Engineers do not anticipate any holdup in the work on Buggs Island Dam . . . Johannesburg, S. A., is adding five 30,000-kw machines to its Orlando station, doubling its size in the second postwar expansion there. . . Pretoria is building a new station to double the system output, and the South African Electricity Supply Commission has awarded contracts for two 132-kv transmission lines 130 miles long.



ICE HARBOR DAM, nine miles above the mouth of the Snake River, as it will look when completed. The power plant will have five 65,000 kw generators, with the first expected to go into operation in December, 1953. Three other dams are planned

FINANCIAL:

Salt River Valley Water Users Association is refunding $4,829,000 of its bonds . . . Grant County PUD, of Ephrata, Wash., has sold $680,000 of revenue bonds at 3.34% . . . Northwestern Public Service, Huron, S. D., has applied to FPC for authorization to issue $700,000 of first mortgage bonds and $700,000 of promissory notes. It also sought authorization for $1,300,000 of 4.5% sinking fund debentures.

COMMERCIAL:

Seattle City Light added 3,164 customers during the 12-month period, ended July 31 . . . Chicago's Electric Association is holding a television and electrical living show this week which attracted almost 100 exhibitors . . . Private utilities supply 86% of the Utah farms which have electric service, according to W. A. Huckins, general sales manager of Utah Power & Light. Average rate is 2.37 cents . . . Illinois farms are 85% electrified, according to A. R. Benson, state agricultural director. The figure is up from 57.5% two years ago . . . Columbia Basin Commission has urged Bonneville to serve the Keokuk Electro-Metals Corp at Rock Island full time starting Nov 1.

Dewey Endorses TVA Steam Plant, Public 'Main Line' Transmission

By George E. Doying, Jr
Electrical World Staff

ABOARD DEWEY CAMPAIGN TRAIN, Sept 21—Gov Thomas E. Dewey, Republican candidate for President, believes the government should transmit federally generated energy away from the power site in order to insure relatively uniform availability of the power throughout the area that can be served.

The Governor stated his position favoring public "main line" transmission of public power during a press conference aboard his special "Victory" campaign train as it rolled across Colorado to Denver. Dewey also restated his position on these points of interest to utilities:

Favors TVA Steam Plant

1. He favors the disputed New Johnsonville steam power plant for the Tennessee Valley Authority, for which Congress this year denied funds despite President Truman's repeated requests.

2. He favors regional multi-purpose developments such as the Missouri Valley Authority plan but is categorically opposed to their administration by a board appointed from Washington. Instead, he favors ruling boards composed of representatives of both the interested federal agencies and of the states involved.

Asked by a reporter, "What is your position on the public distribution of publicly generated power?" Dewey said he had covered the point before, then stated:

Repeats Oregon Endorsement

"In Oregon (the primary campaign last spring) I endorsed the "postage-stamp" plan; that is, to take the energy a certain distance from the plant in that area because otherwise it would create a concentration of industry which is regarded as unhealthy. It ought to be diversified and scattered throughout the area to avoid a heavy growth of concentrated population."

Dewey said the Northwest was a specific example of an area where this is "necessary and a desirable thing."

The candidate's comment opposing a federally-appointed board to run any new regional developments was actually an amplification of the Denver speech text. At Denver, he pledged his administration next year to a policy of maximum multi-purpose development, including power, of the "mighty rivers of the West." However, he said, "no little supermen from Washington (will) be put in centralized control," adding:

"The people in the area, whose lives are so deeply affected, must have a full share in the planning, the construction, and in the operation of the projects."

At the press conference, reporters who had read the speech asked if that meant Dewey was against MVA. Dewey replied:

"I have said before in speeches that I do not believe that the power of life and death over the people of any region should in any new project be delivered into the hands of a small group of men appointed by the President of the United States.

"I do believe that in areas such as the Missouri Valley and the Columbia River Basin, the power, reclamation, irrigation, and other projects should be controlled or should be developed under the guidance of a group representing the agencies in Washington which have to do with them, with equal representation to the people of the area whose existence is so vitally affected by these developments.

"I believe, in other words, that the people in the area have a right to their own representation on the development and the administration of those projects. For instance, in the Missouri Valley there are 11 states which are one-sixth of the land area of the entire country. I don't believe their existence should be dependent upon what three fellows from Washington decide."

Dewey added that this was what has already been done in the Tennessee Valley, but "that is unchangeable and will be left as it is."

Dewey's Denver speech was devoted to the problems of developing the nation's natural resources—land, water, timber, minerals. Except for one reference to the Colorado-Big Thompson project, the Governor did not specifically refer to power projects. But, in discussing water conservation, he said:

Must Develop West Rivers

"We must use the water we have wisely and well. We need the water from our rivers for power as well as for agriculture. We have only begun to use the billions of energy units that now flow unharnessed to the sea. The mighty rivers of the West should be developed with a view to the widest possible use for conservation, power, navigation, flood control, reclamation, and irrigation.

"We should stop quarreling about the means and achieve unified programs which will do the job. In all these new programs, I insist that no little superman from Washington be put in centralized control. The people in the areas whose lives are so deeply affected must have a full share in the planning, the construction and in the operation of the projects."

Calls Big Thompson Important

Dewey termed the Big Thompson project as "one of particular importance to every man and woman in this part of the country. There has been a lot of talk about that project in Washington," Dewey said. "I thought you and I ought to find out who was just talking and who really believed in it. So I brought along the figures. In 1945 and 1946, the Democrats appropriated a total of $13 million. In the last two years, the Republicans furnished not $13 millions but a total of $37 million, or three times as much for Big Thompson. I guess that settles that argument."

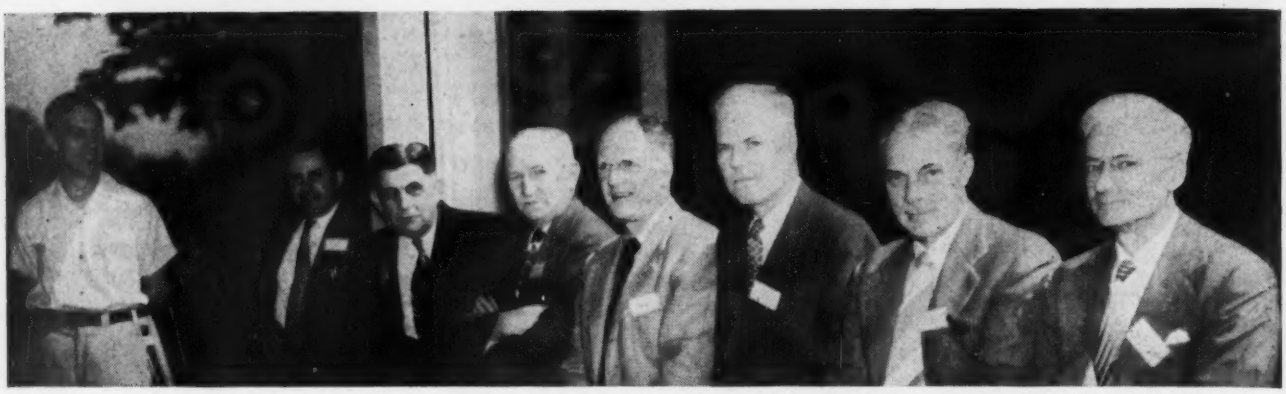
Dewey also defended the record of the 80th Congress on total appropriations for Reclamation projects, a subject which President Truman had introduced in a speech in Denver the night before. Truman charged the Republicans with seeking to wreck Reclamation work by denying the program adequate funds. Dewey told his Denver audience that the 80th Congress had voted 50% more funds in 1947-48 than had been voted by any previous Democratic Congress—$389 million in 1947-48 vs $247 million by the 79th Congress.

July Sets Coal Mark

Power systems are making coal stockpiles while the miners work—but they're using fuel at record levels, too.

FPC reports that stocks on hand Aug 1 totaled 20,827,466 tons. This was the highest level for utility stocks in more than five years and equals an 80-day supply at the record-breaking July rate of consumption. During July, the industry's burn was 8,034,695 tons, the highest July consumption of record.

July's burn of natural gas also set a new record for the month, at 48,435,403 Mcf. Consumption of fuel oil during the month, though, was 14.2% under that of the corresponding month in 1947.



GENERAL ELECTRIC CO's Industrial Heating Course for power-sales engineers of electric utility companies was held Sept 13-17, at Sacandaga Park, N. Y. It was the first such course since 1937 and attracted 170 utility men. Among them were, left to right, R. T. Boswell and C. A. Merlo, Ohio Power Co; E. A. Armstrong, Public Service Co of Northern Illinois; E. L. Kavanaugh, Detroit Edison Co, keynote speaker of the meeting; P. D. Lawrence, Virginia Electric & Power Co; R. W. Noddins, Public Service Co of Northern Illinois; F. A. Berwager, Consolidated Gas, Electric Light & Power Co of Baltimore, and O. H. Marshall, Pennsylvania Electric Co

National Public Information Plan Gets Limited Approval from EEI

THE PRIVATELY-OWNED electric power industry's public information program took an inconclusive step forward last week (Sept 16) when directors of the Edison Electric Institute:

1. Approved a program to spur publication locally of the industry's story.
2. Approved in principle only a national public information program.

Relatively little dissent was expressed regarding the program as adopted at an EEI directors meeting in Cleveland. But the program as adopted differed from that which had been proposed by a directors' committee. The difference lay in the treatment of the proposal that a national program be undertaken. As adopted, the program calls for a new policy committee to study further the proposed national program.

A national program—as proposed—could have been accepted by the meeting, it was believed, but only at the cost of more dissent than was recorded when the amended program came to a vote.

The board approved the expenditure of $40,000 for the program during the remainder of 1948 and a $250,000 budget for 1949. The prospect was that little of either sum would be spent until the recommendation of the new policy committee is received and acted upon.

Pending this report, EEI will continue, perhaps increase somewhat, its dissemination of information for members to use locally. No agency was specified for the public information program, either in the proposal made to the directors or in the program as adopted.

It was expected that the new policy committee, which is to study a national program further, may have a report ready for the next directors meeting in December. No committee had been appointed last week.

Directors' action was more conclusive on the industry research program. The Institute was authorized to hire a research director whose job it will be to ascertain what's in progress and to speed the compilation and dissemination of information derived from research now being conducted by member companies. A committee will be appointed from member companies to help in coordinating and passing out industry research material. The committee will be empowered to recommend specific research projects for EEI sponsorship. And that's the extent of the research program as now envisioned.

Whether this beginning will grow into a broader program, under which a specific research program beyond that now going on under member auspices will be compiled and adopted, remains to be seen. At present, there is no provision for or against such an evolution of the program adopted last week, it was pointed out. It was expected that a research director will have been appointed and be ready to start work by the first of next year.

Two new general committees were authorized by the directors. Neither has yet been named nor have chairmen for either been appointed. One will deal with industrial relations, the other with rural and community development. The first grows out of a recognition that the industry's financing program and attendant investor problems will require more attention than has yet been devoted to them on an industry-wide basis.

The rural and community development committee will attempt to contribute to the promotional work which is being done by an increasing number of electric utilities. It was emphasized that this new committee will not conflict with the Institute's Farm Section or the work of its committees.

Both committees will begin functioning when their members have been appointed.

Two new members were admitted to the Institute. They are the Central Illinois Electric & Gas Co, Rockford, and the Iowa-Illinois Gas & Electric Co, Rock Island, Ill.

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'Non-Due' Bills Win Favor for Southwestern G&E Co

To emphasize the fact that its rates have been reduced six times in the past 20 years, Southwestern Gas & Electric Co has been attaching to its bills a second "non-due" bill. The "non-due" bill tells the customer what he would have had to pay for the same amount of electric energy in 1928.

The campaign has been successful in bringing to the attention of customers the great reduction in the price charged by the utility for electricity. Many commendatory letters have been received from customers and newspapers in the area and have commented editorially on the reductions made by the utility.

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Co-op Increases Capital

Increase in the capitalization of the Top O'Michigan Rural Electric Co, Boyne City, Mich., from $2,500,000 to $6,000,000 has been approved by the membership. The company is a co-op.

ENGINEERING AND OPERATION Section of the Southeastern Electric Exchange meeting at Asheville, N. C., brought together some 200 engineers. Left to right, left panel, E. W. Robinson, Alabama Power Co; J. E. S. Thorpe, president of Nantahala Power & Light Co and of the Exchange; George I. Branch, Ebasco Services; and M. C. Smith, Virginia Electric & Power Co. Right panel, J. B. Coltharp, Gulf States Utilities Co; M. C. Miller, Ebasco Services; Ivan H. Purinton, New Orleans Public Service, Inc; and H. B. Robinson, Carolina P&L

SEE Group Explores Cable Faults, Kilovar Economics and Grounds

NEW LIGHT on location of cable faults and on corrosion-weakness of station grounds was presented and discussed by the 200 engineers attending the Engineering and Operation Section meeting of the Southeastern Electric Exchange, Sept 16-17, at Asheville, N. C. Other significant facts and ideas expressed included the acceptance of reheat and the need for engineers to "minister to the people."

Since 3,091,800 kw of generating capacity will be added in the Southeast by the end of 1951, J. E. S. Thorpe, president of SEE and of Nantahala Power & Light Co, said alert engineering is more essential than ever.

Speaking on the present economics of the utility industry, M. C. Smith, Virginia Electric & Power Co, reported that in August for the first time in 3½ years the backlog of customers seeking service fell below 20,000. Also use of early-men to have line trucks ready at 8 AM has saved 20 to 30 minutes' delay in getting crews rolling for a full 8-hour day.

In comment, E. W. Robinson, Alabama Power Co, said two big needs were better public relations and for the industry to pull together. Also A. E. Knowlton, ELECTRICAL WORLD, urged the need for restudy of system elements and a receptive mind for new developments with an eye toward revolutionary simplification to combat rising costs.

The 5% thermal gain from reheat is attested by practically 2,000,000 kw of such turbogenerators on order with the General Electric Co, said J. B. McClure in citing prevailing power plant trends. He foresees adoption of liquid rheostats for variable speed operation of fans and boiler feed pumps, turbines mounted on condensers, and thoroughly centralized controls. Hydro machines are being built more and more of welded plate construction, said J. P. Roberts, Allis-Chalmers Manufacturing Co, citing the poor availability and quality of steel castings. Other trends were resort to stainless steel, large-scale modernization of governors, and rising interest in pumped operation.

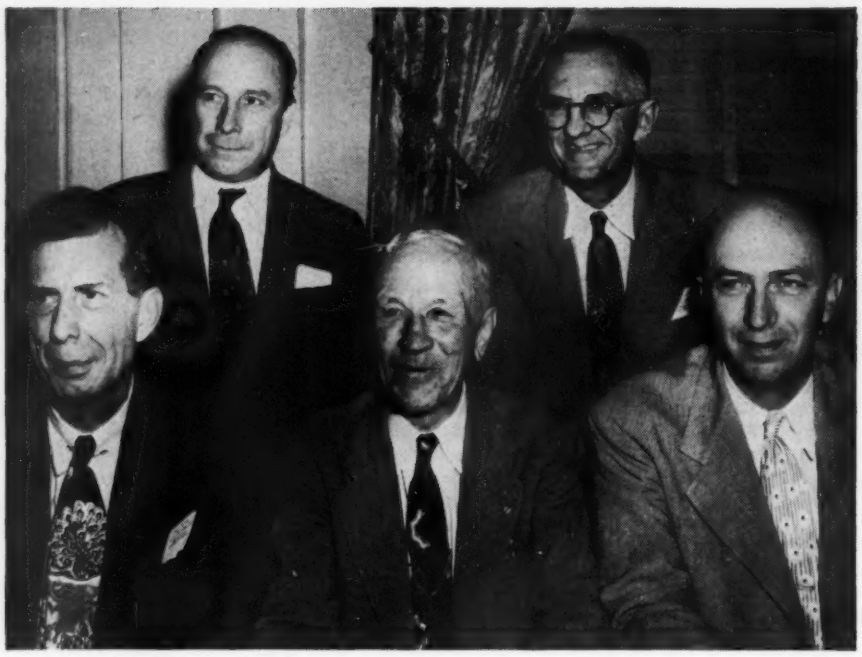
Control of furnace exit gas temperature and automatic vertical adjustment of tangential burners have joined, said W. J. Vogel, Combustion Engineering Co, to permit boilers without boiler surface or baffles. He also detailed the airflow anticipator which starts correction of burner movement before any change in steam temperature is detected. Reheat necessitates comparatively little modification of boiler. In comment, T. E. Crossan, VEPCO, said the "glorified dirt," called fuel, indicated that boilers should not be designed for a narrow range of fuel quality.

Unless some way is found soon to trim operating costs, the utilities can "go broke" producing with existing units while waiting for the benefits of the more economical ones on order. This assertion by George Grimm, Florida Power Corp, was backed up by 10-year statistics showing a tripling in shift-labor cost along with stiff increases in oil prices. He felt a higher grade of plant engineer is going to be needed to run the higher efficiency equipment, but there is difficulty in offering them an attractive opportunity for progression.

By the end of the year installed reactive power generators will equal 19 million kvar, or about 30% of total U. S. installed kw capacity, said Frank R. Benedict, Westinghouse Electric Corp, as part of his talk on aiding system operation. Capacitors will total 13½ million kvar rotating condensers, 5½ million kvar. Cost comparisons for capacitors vs synchronous condensers have broadened so that the curves cross between 10,000-30,000 kva; individual analysis is essential for economic application. Some utilities use capacitors in a fixed block and regulate kvar by switching a small synchronous condenser. E. S. Fitz, VEPCO, commented that relatively long delivery of condensers had favored capacitors and that big investment for switching equipment for reactive units is a pressing problem.

One frequently overlooked way to avoid useless expense is to analyze soil conditions, install as simple a ground as practicable, and then prevent corrosion, according to M. C. Miller, Ebasco Services. In salt water areas sometimes a single rod is as effective as a costly grounding system. For one new station, just two 500,000-cm cables connected to metal piling sufficed. Recent tests show that galvanic action in cables removes lead at a rate ranging from 15 to 150 lb per year, depending upon local conditions. Experimental use of d-c to knock off barnacles looks promising.

A new and promising method for locating faults in underground power cables, as explained by J. P. Lozes, Jr, New Orleans Public Service, Inc, impresses on the cable: (1) Half-second d-c pulses that arc over the fault to give zero fault "resistance"; and (2) superimposed, 3 micro-second 3,000-v surges. An oscilloscope in the circuit then alternately shows the reflection of the 3,000-v surge when the d-c pulse is off and when on. When the d-c is off, the trace is the same as for an unfaulted system; with d-c on, the picture is the same as for a metallic short. The two alternating traces on the screen are



GROUP AT SEE Engineering and Operation Section includes, left to right, W. L. Rush, Louisiana Power & Light Co; R. L. Harris, Alabama Power Co; C. S. Walters, Carolina Power & Light Co; S. L. Muths, Mississippi Power Co; and W. R. Doar, Carolina Power & Light

compared directly. The position of a new tell-tale "pip" is read from a time-scale on the oscilloscope. By using a map of the system previously calibrated in microseconds the position of the fault is fixed.

Capacitors and regulators are an excellent team, said V. R. Parrack, Florida Power Corp. For instance, a 25-mile rural line with zero to full load has these voltage variations: (1) No correction, 120 to 90, or 30 v; (2) capacitors only, 132 to 102, or 30 v; (3) regulator only with 10% boost and 0% buck, 120 to 102, or 18 v; and (4) both capacitor and regulator with 10% boost and 6.7% buck, 124 to 114, or 10 v. He estimates only about half the installations are using bucking capacity of regulators.

Out of 96,000 meters on the Seattle system there are 52,000 carrier-current controlled water heaters. This installation, said Alvin Coyle, Line Material Co, saves the utility the equivalent of 40,000 kw at a cost of $1,000,000. New 40,000-kw station would cost about $12,000,000. C. S. Longenecker, VEPCO, said that in Richmond half of the service calls are to correct time-clocks on water heaters.

Four methods showing the greatest percent reduction in voltage drop compared with the investment, cited by H. A. Wiggins, Georgia Power Co, were (1) change to Y voltage, (2) use of feedback, (3) addition of phase wires, and (4) replace conductors. W. R. Doar, Carolina Power & Light Co, said raising voltage to 13.2 kv is a good way; also in substations they are using tertiary transformer windings and regulators. M. L. Cathey, Georgia Power, said their new 4-kv lines are insulated for higher voltage to simplify later changeover. To guide system planning over the next 10 years, James L. White, Appalachian Electric Power Co, said they expect to start a new analysis similar to the one done in 1939 that has proved so successful.

By 1953, Virginia Electric & Power will have 1,200,000 kva in 110-kv transformers, or double present capacity, said J. A. Rawls. Also, he said, insulating oil is replaced when neutralization number is above 0.5. The company does all its own rebuilding of bushings, and maintenance cost of wood and steel are about the same for the first 30 years.

Engineers were urged by Lewis M. Smith, Alabama Power, to work for national professional status by adopting the central theme of all professional groups—that of ministry to the people. Engineers are largely responsible, he said, for the complexity of modern life so they must increasingly help improve human relations.

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Los Angeles to Sell Bonds

An issue of $9,000,000 electric-plant revenue bonds is expected to be sold about Nov 16 by the Los Angeles, Calif., Department of Water and Power. The department has authorized but not issued a total of $59,000,000 in bonds. Plans for future sale of $10,000,000 water bonds and $40,000,000 hydroelectric bonds have not been completed.

Nebraska Systems to Tie in with Federal Hydros

Nebraska's public power agencies will be interconnected with federal hydroelectric projects now being built in the Missouri River Basin. Interior Secretary Krug announced last week (Sept 16) that his department was near agreement with state agencies on the intertie plans.

Arrangements are being made, Krug said, with the Nebraska Public Power System for distribution of federal power in the area served by the system. Rates have not been determined, he added, but the plan calls for a wheeling agreement whereby the Reclamation Bureau will serve federal agencies through facilities of the Nebraska system.

The system is composed of Central Nebraska Public Power and Irrigation District, Loup River Public Power District, and Platte Valley Public Power and Irrigation District. Interior will work out agreements with other power agencies serving the rest of the state or bring power to those areas over Reclamation lines, Krug said.

The contracts being prepared will cover delivery of energy from plants on the Colorado-Big Thompson project, from Fort Randall Dam, S. D., and other nearby projects. The Reclamation Bureau, which is slated to market all power from Missouri Basin plants, plans to build transmission lines into Nebraska to deliver energy at Columbus, O'Neill, and Ogallala.

The Bureau estimates that it will begin to make this energy available in 1951. The Nebraska Public Power System will provide substations and receive 30,000 kw of firm power initially, according to present plans. The system expects to contract for eventual delivery of 123,000 kw of firm energy and 650,000,000 kwhr annually, with secondary power being supplied as it becomes available.

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AG&E Pays $1,500,000 for Winchester Utility

American Gas & Electric Co has bought the Citizens Heat, Light & Power Co, Winchester, Ind., from the United Public Utilities Corp for $1,500,000.

The acquisition will be integrated with the Indiana & Michigan Electric Co, an AG&E subsidiary, at a cost of approximately $1,250,000. Philip Sporn, AG&E president, will head the new company. Vice-presidents will be Graham Claytor, H. D. Anderson, and Arnold Hogan.

ROCKY MOUNTAIN utility men confer. Left to right are L. W. Cryder, president, Colorado Central Power Co, elected vice-president of RMEL; George Gadsby, president, Utah Power & Light Co; and Fred Wiley, engineer and manager, Colorado Springs municipal plant

RMEL Speakers Emphasize Need of Industry for Men and Money

MEN AND MONEY needed to continue the growth of the industry under business management were the chief concerns of almost all speakers at the 45th annual convention of the Rocky Mountain Electrical League, Sept 13-15, at Glenwood Springs, Colo. More than 300 delegates were registered.

George M. Gadsby, president, Utah Power & Light Co, asked how the public could be prepared to accept necessary rate increases to finance the 75% plant expansion demanded in the next five years. This will require selling over $40,000,000 in securities.

"We have two things to do," said Gadsby. "First we must raise the money and then support it with increased rates. If we don't, we will begin to fall apart."

Saying it would be difficult to get money unless private utilities have competent administration, he said the industry must attract into it younger people who will be inspired by the opportunities in the business and measure up to it. "If we haven't a layer of younger people being prepared to take over some of the administrative tasks, we will fall down as badly in our service as if we had a 'public-be-damned' attitude," he said.

The theme was picked up by Tomlinson Fort, Westinghouse Electric Corp, who reviewed the demands industry and the home will make upon the power industry and told of lack of interest among college graduates in joining the power industry.

William A. Ritt, a former League manager in Minnesota, told of the improvement of the "front line of the industry," electrical contractors and dealers in Minnesota, where they are made a more important part of the industry picture than elsewhere. He urged that dealers and contractors be asked for suggestions and ideas and given a definite place of their own in promotional programs.

"Give them a job to do, but let's do more asking for suggestions from the front line. Don't try to be too paternalistic about it."

In recounting the story of how the Bureau of Reclamation is endeavoring to parallel all generating and distribution facilities in the Rocky Mountain area to steal the load developed by the private utilities and municipalities, John E. Loiseau, president, Public Service Co of Colorado, also touched on rates and public relations policies. He urged setting aside money for improvements to be used when times are not so good.

JOHN LOISEAU, president, Public Service Co of Colorado, addresses RMEL session

Edwin Vennard, vice-president, Middle West Service Co, Chicago, in a talk that was the keynote of the convention, said that like it or not, the world was apparently dividing into two groups, one tending toward totalitarianism, the other fighting for individual freedom. He quoted figures from surveys indicating that a high percentage of American people in all walks of life favor collectivist theories.

"Let's not guess what anybody thinks. Let's measure their opinions and find out," he suggested. "Don't blame them. Ask ourselves, 'To what extent am I responsible for their lack of knowledge?' Our job is to find out how to bridge the gap that has grown between management and employee. We must so live that employees will want to work for us, that people will want to do business with us. We must survey employee and public opinions regularly and continuously furnish all the facts about the company and about the enterprise system at large."

At the banquet, Dr Adam S. Bennion, describing what he meant by "We have a job to do," said the industry has a three-fold task: (1) to supply the needs of America with power, (2) to choose and train men to be the successors of the present generation, (3) to build such a defense that the industry shall not be taken from those who have pioneered it and that will put brakes on a program that has already socialized Britain and threatens to overtake the world.

Harold Rankin, manager of lighting, Public Service Co of Colorado, was chosen president. Also elected were four vice-presidents, H. L. Pinkerton, Public Service Co of New Mexico; W. D. Johnston, Mountain States Power Co; J. W. Cryder, Colorado Central Power Co; and R. H. Adams, Hendrie & Bolthoff Co, Denver. W. C. Sterne was again reelected treasurer for the coming year.

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Virginia Cracks Down on Trailer Submetering

Submetering of power by trailer camps has been forbidden by the Virginia Corporation Commission in an action involving the operators of two camps near Hampton.

Virginia Electric & Power Co was authorized to cut off electricity. The Commission found the two men in violation of the power company's regulations, filed and approved by VCC, which prohibit sale of power obtained from a utility.

Employers Praised as IBEW Acts to Win Workers Economic Security

IF AN EMPLOYER in one of various branches of the electrical industry had attended the 23rd convention of the International Brotherhood of Electrical Workers at Atlantic City last week—as did a representative of ELECTRICAL WORLD—he would have learned at least two things:

1. He is not making any trouble for the union.

2. The union may have some trouble in store for him.

For the 2,500 delegates didn't lodge a single grievance against management. Rather, they fired their shots at Congress and rival unions.

Contractors Head Speaks

The convention received enthusiastically the goodwill speeches by Robert W. McChesney, president of the National Electrical Contractors Association and an IBEW member, and Albert T. O'Neill, president of the Buffalo-Niagara Electric Corp. Even Louis Sherman, IBEW general counsel, said the union was "fortunate in having its contracts with the best employers, taken as a group, in the United States."

The delegates themselves set aside resolutions asking for vacations and holidays with pay in the construction industry and for a 30-hour week. There was no "pie in the sky" talk of higher wages. Even proposals for increasing the $50 monthly pension were defeated, as were other measures for reducing the pensions or extending them to more members.

Major concern of the delegates was to build up the economic security of the 450,000 members they spoke for. This was exemplified in the many resolutions and constitutional amendments covering work jurisdiction, pensions, social security, and public construction.

Jurisdictional Fights Coming

It's on jurisdiction questions that management may run into trouble from IBEW. It may come through organization of non-union workers in all branches of the industry or IBEW's refusal to continue to recognize the new jurisdictional disputes plan in the construction industry.

As to the first, there is an internal problem for the IBEW. Several defeated constitutional amendments sought to redefine the jurisdiction of each of the five branches of IBEW, particularly as to which branch has a right to electronics workers.

The IBEW raised a threat to the success of the Joint Board for Settling Jurisdictional Disputes in the Construction Industry when it gave President Dan Tracy his request for authority to pull out of the AFL Building Trades Department, which would mean quitting the jurisdictional disputes plan of which it is a party, whenever he deems it advisable to protect the union's interests.

IBEW doesn't like some of the existing jurisdictional decisions being used to decide disputes under the new plan. It might quit the setup whenever it gets a decision it doesn't like and doesn't want to abide by.

The convention urged Congress to repeal the Taft-Hartley Act, to improve social security benefits and to accelerate the development of the Columbia River Dam sites and provide ample funds "for the erection of transmission lines and substations to permit the decentralization of electro industries throughout the entire Northwest region."

Tracy seems to have regained complete control of the union, whose leadership he gave up in 1940 to become Assistant Secretary of Labor. He had been president seven years and regained the office two years ago at San Francisco, replacing E. J. Brown. Elections are every four years.

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Missouri Sale Approved

Missouri Public Service Commission has approved sale by Missouri Edison Co, Louisiana, Mo., of some 26 miles of distribution lines serving 40 customers in St. Charles township. The Union Electric Co of Missouri, St. Louis, paid $13,000 for the property.

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30,000-Kw Unit Added

Southwestern Public Service Co has placed in operation at its Riverview Plant, near Borger, Tex., a 30,000-kw steam turbogenerator. It is claimed that the new Westinghouse unit is the first 30,000-kw "standardized' machine to be built by any American manufacturer for electric power generation.

MEETINGS

Edison Electric Institute—Meter and Service Committee, Joint meeting with the AEIC Committee on Metering and Service Methods, Sir Walter Hotel, Raleigh, N. C., October 4-6. H. S. Bennion, managing director, 420 Lexington Ave., New York 17, N. Y.

PREVIOUSLY LISTED

Association of Iron and Steel Engineers—Convention and Iron and Steel Exposition, Cleveland Public Auditorium, Cleveland, Ohio, September 28-October 1.

International Association of Electrical Leagues—Annual Conference, Mayflower Hotel, Washington, D. C., September 29-October 2.

Canadian Electrical Manufacturers Association—Annual General Meeting, General Brock Hotel, Niagara Falls, Ont., September 30-October 1.

American Institute of Electrical Engineers—Middle Eastern District Meeting, Statler Hotel, Washington, D. C., October 5-7; Mid-west General Meeting, Hotel Schroeder, Milwaukee, October 18-22; Southern District Meeting, Tutwiler Hotel, Birmingham, Ala., November 3-5.

Missouri Valley Electric Association—Rate Practice Group, October 7; Power Sales Committee, October 15; all at Hotel President, Kansas City, Mo., Accounting Conference, Connor Hotel, Joplin, Mo., October 21-22; Engineering Committee, Hotel President, Kansas City, Mo., October 26; Rural Round Table, The Elms, Excelsior Springs, Mo., October 27; Sales and Rural Conference, The Elms, Excelsior Springs, Mo., October 28-29.

Pennsylvania Electric Association—Transmission and Distribution Committee, Bedford Springs Hotel, Bedford, Pa., October 7-8; Prime Movers Committee, Carver House, Warren, Pa., October 28-29.

Edison Electric Institute—Prime Movers Committee, William Penn Hotel, Pittsburgh, October 11-12; Transmission and Distribution Committee, New Ocean House, Swampscott, Mass., October 11-12; Electrical Equipment Committee, William Penn Hotel Pittsburgh, October 14-15.

Indiana Electric Association—Annual Convention, French Lick Springs Hotel, French Lick, Ind., October 13-15.

Electrochemical Society—Fall Congress, Hotel Pennsylvania, New York, October 13-16.

Utility Workers Union of America—National Convention, Washington Hotel, Washington, D. C., October 15-17.

Southeastern Electric Exchange—Accounting Section, Sir Walter Raleigh Hotel, Raleigh, N. C., October 28-29; General Sales Conference, Atlanta Biltmore Hotel, Atlanta, Ga., November 10-12.

Wisconsin Utilities Association—Commercial and Technical Divisions of Electric and Gas Sections, Pfister Hotel, Milwaukee, November 1-3.

National Electronics Conference—Edgewater Beach Hotel, Chicago, November 4-6.

Public Utilities Association of the Virginias—Annual Meeting, Greenbrier Hotel, White Sulphur Springs, West Virginia, November 5-6.

National Electrical Manufacturers Association—Annual Meeting, Hotel Traymore, Atlantic City, November 8-13.

National Farm Electrification Conference—Congress Hotel Chicago, November 17-19.

American Society of Mechanical Engineers—Annual Meeting, Hotels Pennsylvania and New Yorker, New York, November 28-December 3.

National Exposition of Power and Mechanical Engineering—Grand Central Palace, New York, November 29-December 4.

National Electrical Contractors Association—Annual Meeting, Roney Plaza Hotel, Miami, Fla., November 30-December 3.

Reclamation Will Lay Off 1,000 on California Job

Layoff of about 1,000 construction workers, most of them on California's Central Valley project, will soon be announced by Regional Director Richard Boke of the Reclamation Bureau. Workers are being laid off now.

The action comes as a result of a limitation on the number of persons who may be employed by the Bureau. The limitation, setting wage and salary funds for such employees at $48,000,000 for the 1949 fiscal year, was contained in the 1949 Interior appropriation bill.

Reclamation, it was pointed out, has ample funds to continue the projects authorized for the year, but must spend them for construction under contract rather than for construction by force account. That accounts for the layoffs. Estimates are that it will take a minimum of 60 to 90 days for advertising of contracts and letting of bids. This period could run as high as six months.

The layoffs come at what could be a strategic time in the presidential campaign. Both candidates are touring the West, trying to outpromise each other on public works spending.

It was indicated that similar, although probably smaller, layoffs, are being effected in other regions now.

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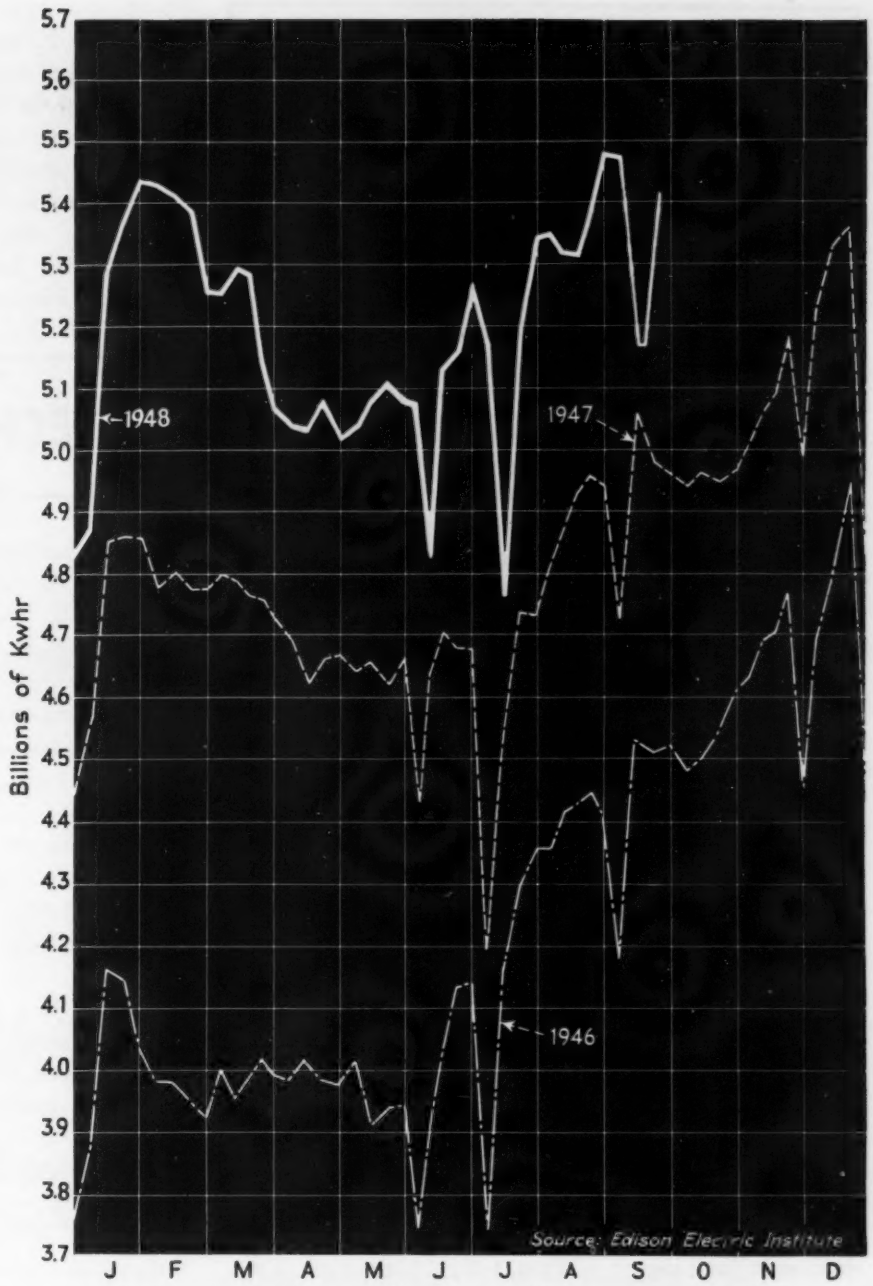
Portland General Electric Opposes Co-op Franchise

Portland General Electric Co is opposing a plan to grant a Salem, Ore., franchise to Salem Electric, a cooperative now providing a restricted electric service in the Salem area.

The utility has filed a suit in Salem circuit court to remove the proposed franchise from the November election. The complaint charges discrimination against Portland General Electric and misleading wording of the ballot title. In two previous elections Salem voters have rejeced proposals to grant a general city franchise to Salem Electric, which operates in a portion of the business section on a permit basis.

Other News

New Equipment	Page 138
News About People	146
Manufacturers & Markets	150
Recent Rate Changes	153
Construction	154



Output Holding Close to 10% over 1947

Recovering from its Labor Day slump, output of central electric stations rose to 5,426,247,000 kwhr for the week ended Sept 18. This increase is slightly less than that made for the corresponding week in the past two years. It may be attributed in part to the later date of Labor Day. But again the overall increase of 9% for the United States over the output of the corresponding week of 1947 is close to the 10% average which has been recorded throughout 1948. For the entire year, the upward trend in the West Central and Pacific Coast areas has balanced declines in New England, Mid-Atlantic, and Rocky Mountain areas. The return of cool weather and to standard time will give the utilities a respite of about two months before they will be faced with meeting the winter peak.

Weekly Output, Millions Kwhr

1948	1947	1946
Sept 18 5,426	Sept 20 4,977	Sept 21 4,507
Sept 11 5,166	Sept 13 5,053	Sept 14 4,521
Sept 4 5,470	Sept 6 4,721	Sept 7 4,184
Aug. 28 5,478	Aug. 30 4,940	Aug. 31 4,404
Aug. 21 5,391	Aug. 23 4,953	Aug. 24 4,444
Aug. 14 5,318	Aug. 16 4,923	Aug. 17 4,422
Aug. 7 5,319	Aug. 9 4,874	Aug. 10 4,412
July 31 5,352	Aug. 2 4,806	Aug. 3 4,351
July 24 5,342	July 26 4,730	July 27 4,352

Percent Change from Previous Year

	Sept 18	Sept 11	Sept 4
New England	+ 6.4	— 1.9	+17.9
Mid-Atlantic	+ 6.0	— 3.1	+11.7
Central Industrial	+ 8.8	+ 1.0	+17.2
West Central	+11.5	+ 4.7	+19.9
Southern States	+ 9.4	+ 4.5	+15.0
Rocky Mountain	+12.5	+ 8.7	+13.8
Pacific Coast	+11.4	+ 6.1	+17.8
Total United States	+ 9.0	+ 2.2	+15.9

WASHINGTON COMMENT

WILLIAM B. WHICHARD

BASED ON past performances, the natural gas industry is due to begin screaming again about the Federal Power Commission any day now. When it does, other people who have to deal regularly with FPC will derive a somewhat morbid satisfaction therefrom. They may even feel entitled to snicker.

That, of course, won't make it easier for anyone to do business with the Commission. For at least another four months, perhaps longer, FPC is likely to be as unpopular with utility company people—and vice versa—as it was at the height of the New Deal.

No one, in recent years at least, has seriously accused the Commission of being chummy with the industry it regulates. But during the last two years, under its present chairman, FPC made a start toward dispelling the atmosphere of mutual suspicion and antagonism that engulfed even its most routine contacts with business.

Chairman Smith encouraged industry people to talk out their regulatory problems over the conference table, either with the commissioners or with their staff aides. The result, on the relatively few occasions when this procedure was tried, was a more realistic approach by the Commission in its formal deliberations.

Industry people still can confer with members of FPC or its staff. But they should not kid themselves. They no longer are dealing with a Commission controlled by Chairman Smith. Once again, former Chairman Olds holds the reins. And there's no indication that the Leland Olds of 1948 is any different from the Leland Olds who told New York Democrats last winter that the time was ripe for another political crusade against utility companies.

First hint that FPC again was on the old track came when it leaped eagerly to remove conditions from the license it had issued to First Iowa Hydro-Electric Cooperative—conditions which the co-op might never have been able to meet to the satisfaction of a less sympathetic Commission majority.

The vote on First Iowa Hydro was the first official show of strength by the new FPC majority. As expected, new Commissioner Buchanan aligned himself with Olds and the veteran Claude Draper, with Chairman Smith dissenting. Commissioner Wimberly, who generally has voted with the chairman in previous FPC splits, was absent.

Voting control of the Commission gives Olds general direction of its activities, as well as the final say on its formal decisions. Fortunately for the electric power industry, the most important matters now before FPC are natural gas cases, especially the allocation of pipe line gas for the coming winter.

If gas men find themselves unhappy over the way FPC handles these cases, they can thank themselves for at least a portion of their troubles. It was gas industry objections that blocked Senate confirmation of Burton Behling, Truman's first selection for the vacancy on FPC, last year.

Upshot of the ruckus over Behling, who was sponsored by Chairman Smith, was the withdrawal of his nomination in favor of that of Buchanan, a warm adherent of Olds. The Senate failed to confirm Buchanan also, but Truman put him on the Commission anyhow with an interim appointment. And there he will stay until the Senate rejects his nomination or a new President replaces him.

TECHNICAL TRENDS

ARCHER E. KNOWLTON

Outdoor boilers will be a feature of almost 50 (totalling 1,700 Mw) of the new power plants. In fact, a third of these (596 Mw) also will have the turbines and auxiliaries outdoors.

Generator breakdowns can be due to corona injury to coil insulation if there is poor or uncertain surface contact between the insulation and the slot iron.

Moist cable may puncture under 450 volts negative but withstand 600 positive. Electrosmosis is cited as the reason why cable insulation should reflect much the same polarity characteristic as is identified with point gaps and lightning.

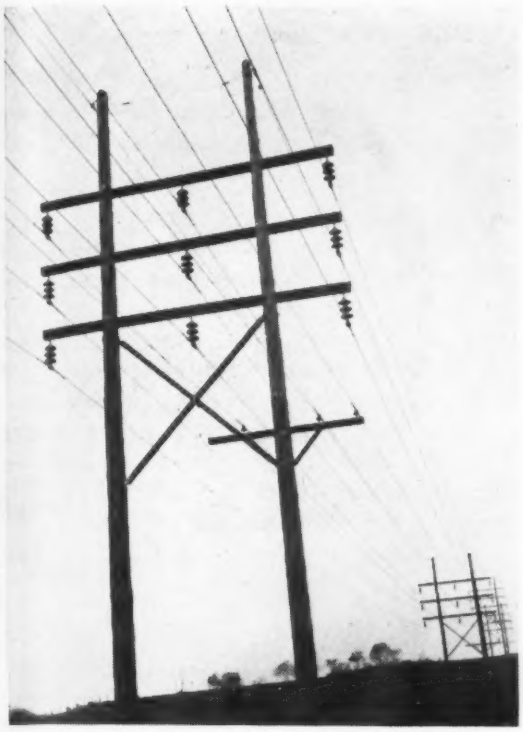
Transformer oil purification is high in economic importance because of (1) prevailing loadings, (2) the increase in stocks of sludged and oxidized oils and (3) the prospective pinch in natural oil supply. Some 12,000,000 gallons will be bought this year for replacement use in transformers and breakers.

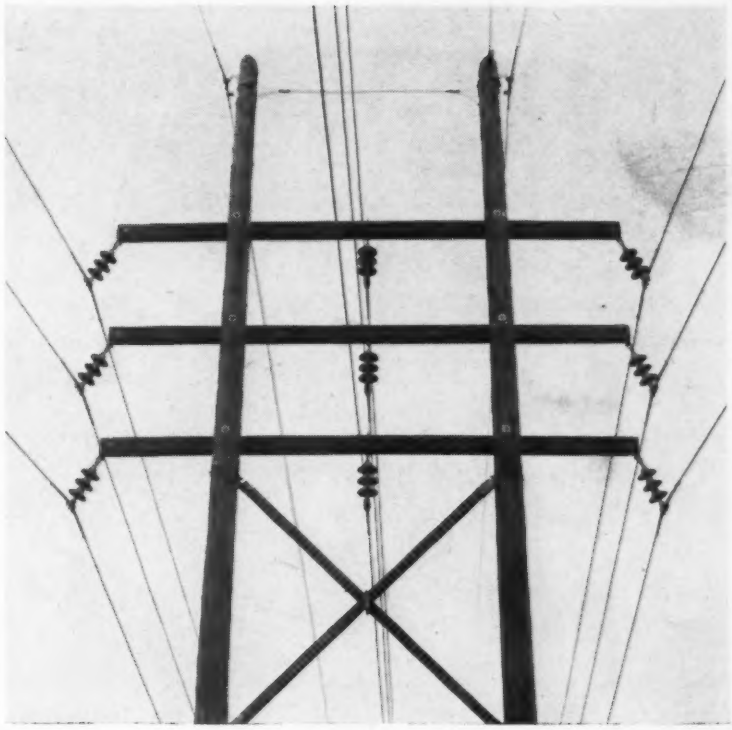
Substations invariably were housed in buildings until the economy of outdoor installation was forced in the effort to combat the private industrial power plants. The pressure for elimination of costly buildings and enclosures is again acute.

Distribution expansion, reinforcement and replacement will take $10,000,000,000 in 10 years according to a prophecy based on inevitable load growth.

Strainers ahead of turbine valves must be truly corrosion-resistant otherwise the small parts of disintegration can do costly damage to the valves.

Hydrogen cooling of alternators is firmly established here but the British have just installed their first, a 75,000 kva. Fifty cycle speeds were enough lower than 60 cycle to weaken the incentives—until sizes also crept up.





TANGENT STRUCTURE left above, has three vertical 25-kv circuits protected by two overhead ground wires. Underbuilt circuit is 6,900v. The H-frame construction, right, was used adjacent to three-pole long span angle structure. Middle ground wire of long span is dead ended

Triple-Circuit Line Cuts Lightning Area

Three 25-kv circuits on braced H-frame structures carry 30,000 kw through region of severe lightning area—Wood and porcelain teamed to provide high impulse strength

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TWO-CIRCUIT TRANSMISSION LINES are commonplace in this country. But a three-circuit line on braced H-frame structures, plus lightning-proof features, is a rarity.

Such a triple-circuit 25-kv line was built recently by West Penn Power Co to transmit 30,000 kw some 3¼ miles through an area of severe lightning exposure. Two of the line's three circuits can carry the entire 30,000-kw load in the event that any individual circuit is inoperative. However, further reliability of service is provided by other 25-kv sources that tie into the service area.

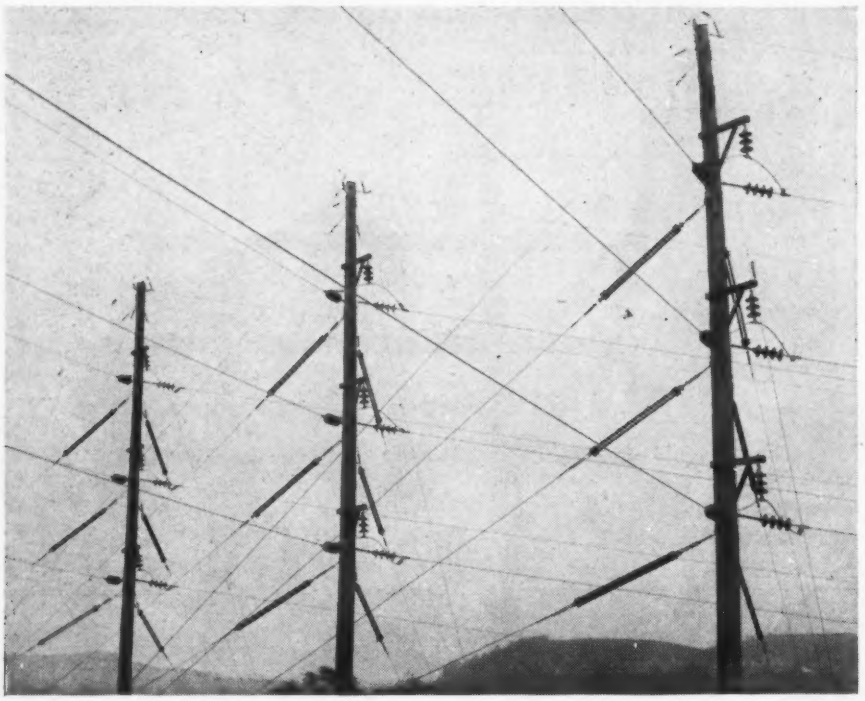
Known as the Kiski Valley-Vandergrift line, this triple-barrelled run is protected by two overhead ground wires. It replaces an unprotected double-circuit, single-pole line on which a majority of the poles had less than eight years of life remaining.

H-frames Replace Single Poles

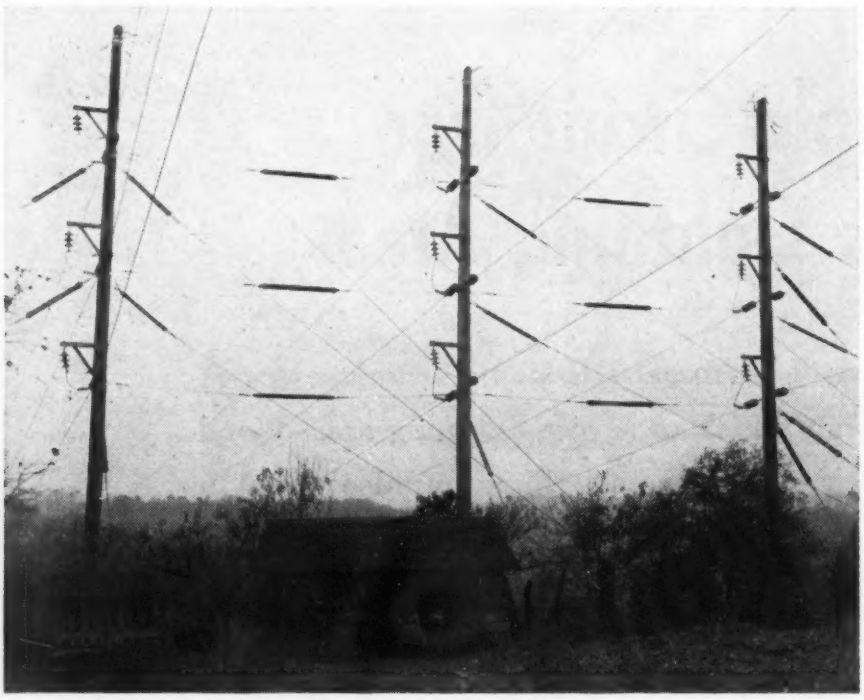
Decision to use H-frame structures for the new line was made in the face of one alternative. This was to rebuild the old two-circuit line and provide a new single- or double-circuit line over a different route. The single, three-circuit line, however, had the advantages of bracing in the H-frame structure; less cost for clearing right-of-way; economy in distributing material and stringing wire. Also the H-structure provided better shielding for the middle circuit.

One or two 6,900-v lines are carried on the structures over part of the route.

Ground wire protection and increased impulse strength provides an approach to lightning-proof design. Two ground wires, 9 ft 3 in. above the top conductors, give a shielding angle of about 30 deg. Phase con-



ANGLE ARRANGEMENT where line turns 63 deg—44 min. Special 1,411-ft span is at right. Dead ends are guyed both ways. Grounding is through anchor and head guys at the pole tops



THREE-POLE STRUCTURE at 10 deg—48 min angle. Spans are 1,411 ft at left; 247 ft at right. Long span dead ends are guyed and all wire positions are tied across the structure horizontally. Grounding is through anchor and head guys at the pole tops

ductors are supported by strings of three 10-in. suspension insulators with 5¾-in. spacing. There is five feet of wood between them and the nearest ground wire. This combination of wood and porcelain provides more impulse strength than the pin-type construction normally used on company's 25-kv transmission lines.

Estimates indicate the following impulse values for the new line:

	2 Microseconds	Critical
Positive	995 kv	850 kv
Negative	1,160 kv	990 kv

Critical impulse flashover values for the insulator arrangements considered are:

3 Suspension Insulators 350 kv
4 Suspension Insulators 415 kv
Pin-Type Insulators....200 kv

At dead-ends, insulation consists of four suspension units per phase. The assembly is isolated from ground by a 6-ft wood-strain insulator in each anchor guy.

Guying problems at angles on each side of one 1,411-ft span called for extra pole spacing to provide clearance between the top guy wire of a circuit inside the angle and the bottom power conductor of the next outer circuit.

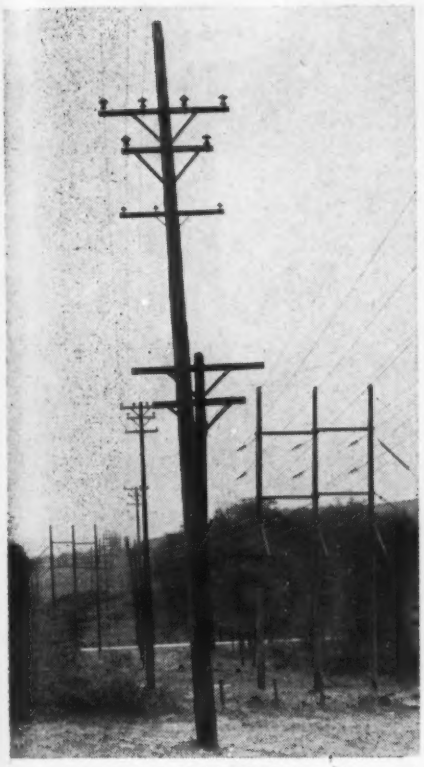
Normal circuit spacing of 10ft-3 in. was increased to about 34 ft in this long span. Spacing between the three dead-end angle poles on each end of this span are:

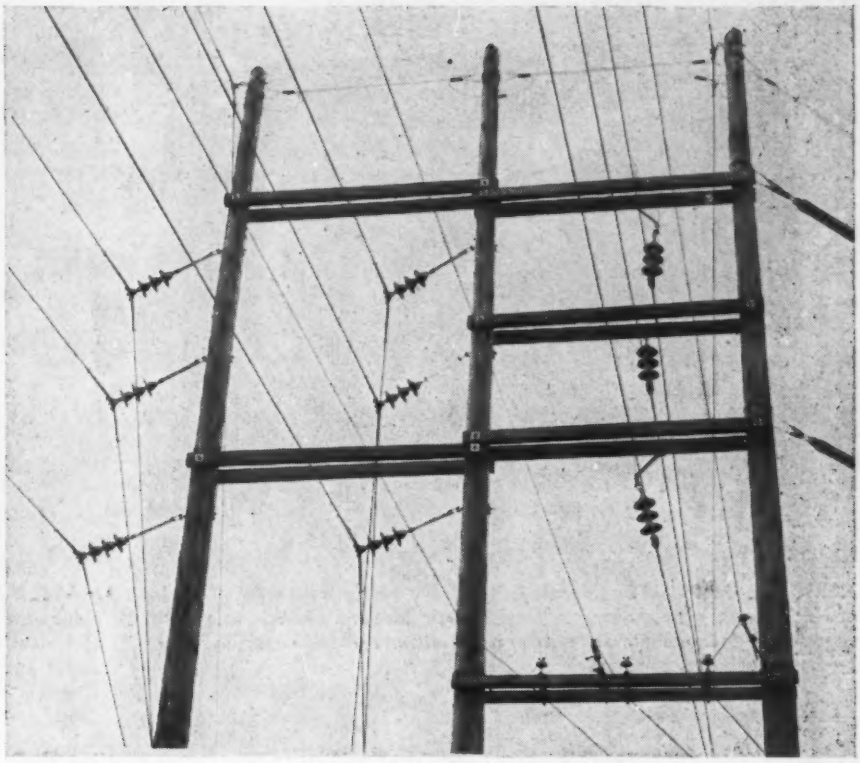
Angle	Spacing	Pole Height
63° 44′	40 ft	65ft
10° 48′	34 ft	65ft

The conductors were guyed both ways at the larger angle. Structures in the smaller angle were tied together and guyed against stress in the long-span only.

A ravine about 920-ft wide, at another point in the line, had a contour that suggested use of a "tie-down" structure. Such an arrangement split this distance into 340-ft and 580-ft spans. It also allowed the use of two-pole tangent structures without changing circuit spacing. This 65-ft structure, with suspension insulator strings reversed, saved 10 ft in structure height. Insulator caps were attached to the wire clamps and the bottom of the strings were fastened with socket clevises in eye bolts at the top of the arm. An extra set of wood X-braces was used at the top of the structure on each side of the 580-ft span.

Circuit layout in the two terminal substations was such that the new structures started on one side of the existing 25-kv double-circuit line and ended on the other. Temporary 75-ft poles were used to raise the double-circuit line, at the point of crossing, so that the new conductors could be strung under the energized conductors. Fortunately, ground contour formed a valley at this crossing. Thus the conductors could be





TEMPORARY CROSSOVER left above, where existing 25-kv double-circuit was raised on 75 ft poles to permit stringing of wire in the new circuits. Double circuit line will be removed at substations, right above. Circuits go from vertical to horizontal as they enter substation switching bays

raised for several spans without splicing. This temporary crossing was removed after the new circuits had been energized.

Grounding at each pole, in straight sections of line, consisted of a No. 1/0 solid-copper coil under the pole butt and extended up 8 ft above ground line. Overhead ground wires were tied together across the top of each structure with three No. 6 EHS guy wire and connected to ground coils with No. 4 copper.

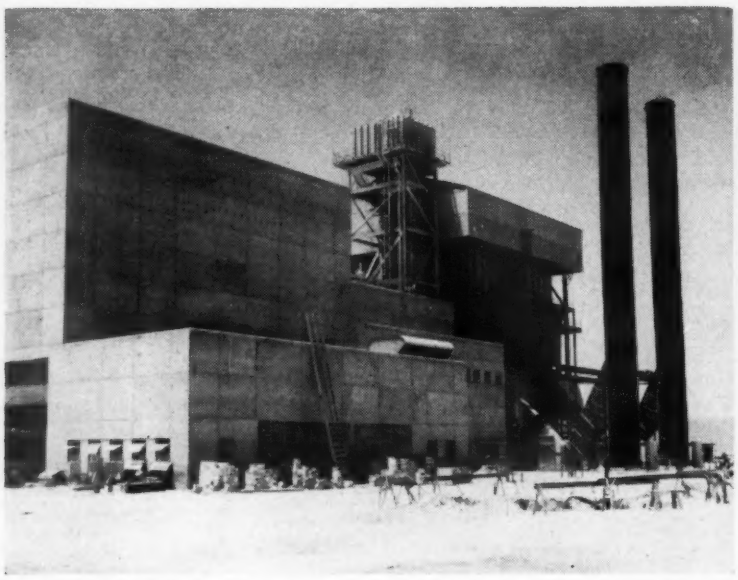
Grounded anchor guys were used as ground leads at angles instead of the No. 4 copper risers. Initial resistance readings varied from 5½ to 125 ohms. Counterpoise or parallel grounds were added to reduce resistance at each structure to a maximum of 30 ohms.

The middle circuit of the line was continued on single poles to a customer's substation for about two-thirds of a mile beyond the terminal. Vertical construction with ground wire protection was used. These structures are arranged so a second circuit can be added if needed.

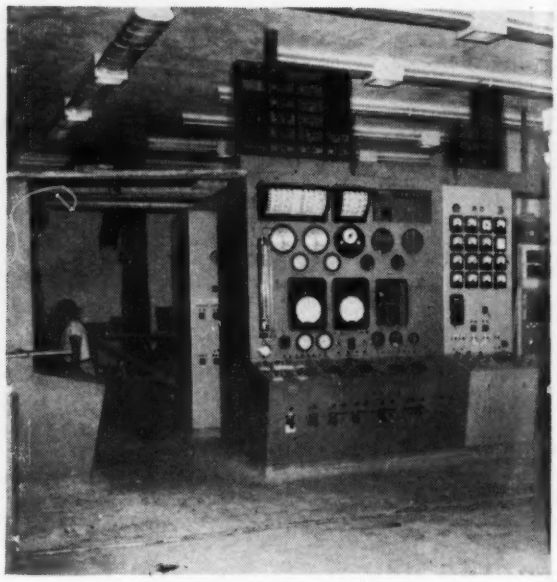
A summary of information on the line is shown in the table. Typical structures are illustrated in accompanying pictures.

STATISTICS OF THREE-CIRCUIT LINE

Length—	Three-Circuit —17,260 ft (3¼ miles) Single-Circuit —3,814 ft (.72 mile)
Spans—	Three-Circuit —Max —580 ft Min —120 ft Avg —300 ft Single-Circuit —Max —380 ft Min —110 ft Avg —224 ft Special Three-Circuit Span—1,411 ft
Conductor—	Ground Wire —159,000 cm—ACSR 25-Kv 336,400 cm—ACSR 6.9-Kv 3/0 ACSR
Maximum Tension (Heavy Loading 8 lb wind ½ in. ice)	Ground Wire —4,630 lb 25-Kv —3,000 lb 6.9-Kv —2,000 lb Special Three-Circuit Span (1,411 ft) Ground Wire —7,325 lb 25-Kv —7,025 lb
Poles—	Three-Circuit —55 Structures 116 Poles —55–70 ft (Nominal 60 ft) Single-Circuit —16 Poles (Nominal 60 ft)
Arms—	Three-Circuit —6 in. x 8 in. x 21 ft–6 in. creosoted pine Single-Circuit —4 in. x 6 in. x 12 ft–0 in. fir
Insulators—	15,000 lb—10 in. Suspension—5¾ in. spacing Strings of 3 units in suspension Strings of 4 units at dead ends
Spacing of Conductors—	Tangent Structures Ground wires on poles spaced 11 ft Vertical 25 kv circuits—separated 10 ft-3 in. Conductors in each circuit 5 ft vertical spacing Ground wires supported 9 ft–3 in. above 25 kv
Spacing of Conductors—	Special Three-Circuit Span (1,411 ft) Vertical 25-kv circuits and ground wires separated 33 ft–10 in. Conductors in each circuit— 10 ft–5 in vertical spacing Ground wires supported 9 ft–11 in. above 25 kv
Guying—	3-No. 6 E.H.S. Copperweld ⅜ in. E.H.S. Copperweld 6 ft wood strain insulators double wood sections 1⅛ in. x 3¾ in. with wedge type end fittings.
Grounding—	Coil of 1/0 solid copper wire stapled to butt of pole and 1/0 lead running 8 ft above ground. No. 4 copper to pole top. Grounded anchor guy at angles and dead ends.



KERN STEAM PLANT of Pacific Gas and Electric Co brought in 60,000 kw of much-needed capacity early in May. Though designed primarily as peaking capacity for a basically hydro system, it will operate at full capability during present tight power situation



MASTER CONTROL PANEL is heart of plant's completely centralized control system. Layout of major plant equipment is symmetrical about and parallel to north-south center line which passes directly in front of this panel

Control Is Centralized At Kern Station

COMPLETE CENTRALIZATION of control is paramount in the design of Pacific Gas and Electric Co's new Kern steam plant. Result will be closer coordination in plant operation with only 50-60% of the operating manpower required by a conventional plant of the same size. This closer coordination and substantial reduction in operating expense will more than justify the slightly greater first investment.

Decision to use centralization to the fullest possible extent in the 160,000-kw plant was based primarily on previous satisfactory experience. Three similar plants totaling 160,000 kw have been successfully operated with limited centralization of control for five to eight years on the PG and E system.

Design of the centralized control system goes considerably beyond mere physical grouping of operating controls at one point, which is now fairly common. Basic purpose of the design is to provide operators in the control room with direct physical access to plant equipment. To accomplish this the basic design placed particular emphasis on physical layout and automatic operation.

Location of equipment all on the same floor level and in close proximity to the control center makes for quick and easy patrol by the operators. Close personal contact between members of the operating crew also increases coordination in overall plant operation. Particularly in case of emergency, such coordination assists in determination and execution at one spot of a coordinated course of action.

Operators Specially Trained

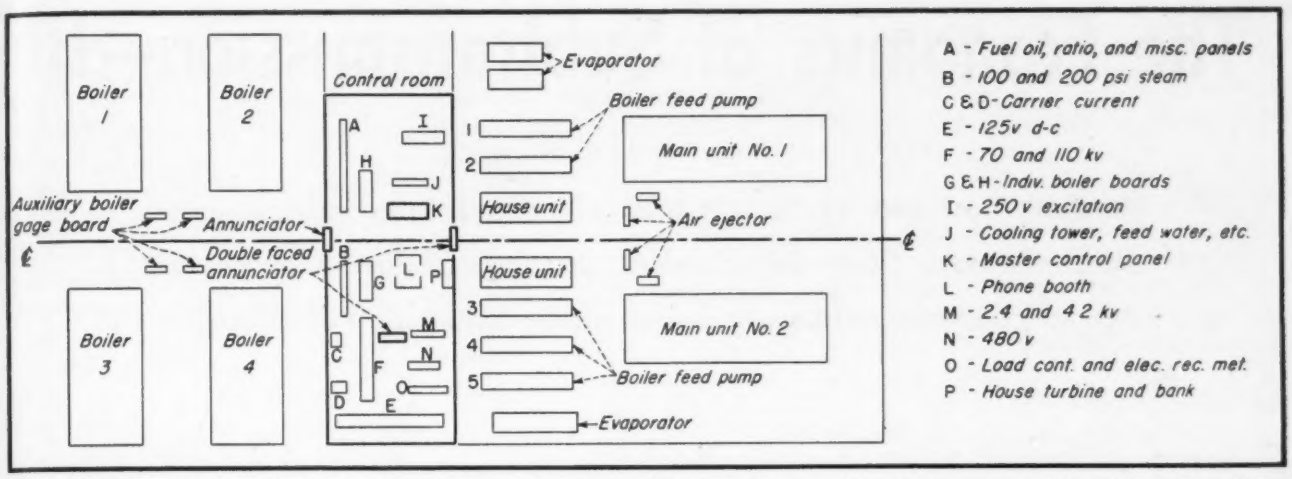
Under normal conditions plant operation will be largely automatic with a wide variety of liquid level, pressure and temperature controls to take over routine operations. About half the operators chosen for the plant had previous experience with limited centralization of control. All were given special training before the plant went in operation.

Regular classes were held daily to explain to the men operation of specific new equipment and general overall plant operation. Class work was supplemented by actual contact with the equipment during final stages of installation, first operation and testing. By the time the units were in operation the operators were quite familiar with the equipment and controls.

An extensive aural and visual annunciator system rounds out the centralized control of the plant. The function each annunciator represents is printed in large black letters on its 6 x 12 in. frosted glass window. Loss of any of the main operating units of the plant is indicated on windows with a red background. Transfer to standby auxiliaries caused by failure of an auxiliary in regular operation is indicated on a yellow background. Remaining units have the black lettering on a white background.

Clear visual indication of the function affected is provided the operator when the window is lighted. The aural alarm can be stopped and reset for other alarms without clearing the annunciator light. Such a clear visual reference to important plant functions incidentally provides further informal training in familiarizing the operators with the working of the plant.

Completion of the plant's first unit early in May 1948 added 60,000 kw of much-needed capacity to the southern end of the PG and E system.


Boiler 1
Boiler 2
Boiler 3
Boiler 4
Control room
Auxiliary boiler gage board
Annunciator
Double faced annunciator
Evaporator
Boiler feed pump
Main unit No. 1
House unit
Air ejector
House unit
Main unit No. 2
Boiler feed pump
Evaporator
A - Fuel oil, ratio, and misc. panels
B - 100 and 200 psi steam
C & D - Carrier current
E - 125v d-c
F - 70 and 110 kv
G & H - Indiv. boiler boards
I - 250 v excitation
J - Cooling tower, feed water, etc.
K - Master control panel
L - Phone booth
M - 2.4 and 4.2 kv
N - 480 v
O - Load cont. and elec. rec. met.
P - House turbine and bank

MAIN UNITS are located about center line. Operator at master control panel can see and has quick access to firing aisle, main and house units and major auxiliaries. Proximity of equipment and its location on one floor level make for easy patrolling from the control room

During the present period of slim margin between system load and capacity, the plant will operate up to its full capability. Under normal conditions it will provide peaking capacity for the company's predominately hydroelectric system.

Can Take Full Load in 30 Sec

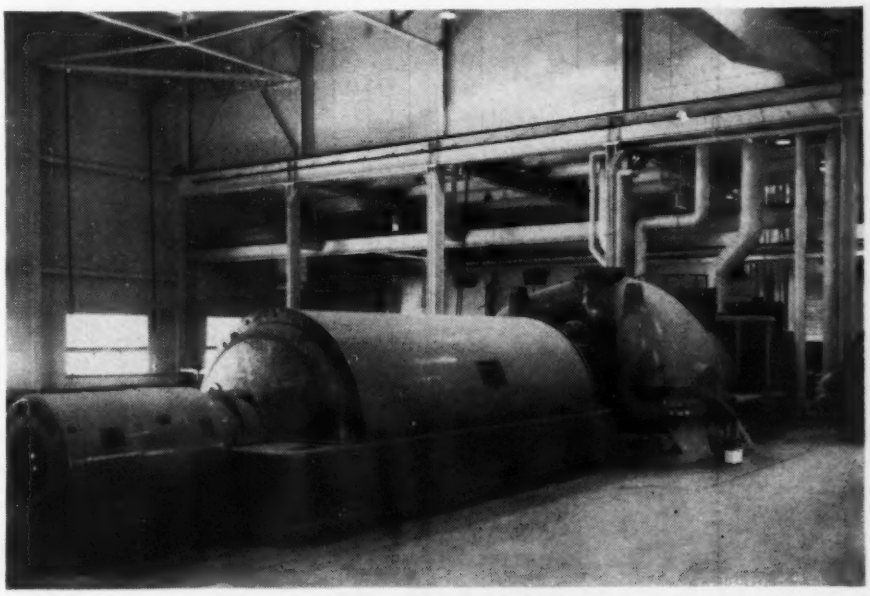
To accommodate wide fluctuations of load at the southern end of the system, the plant is designed to float on the line, pick up full load in 20 to 30 sec when necessary. Each one of four radiant type boilers will supply 450,000 lb of steam at 1,380 psig and 935 F per hour, with overload capacity of 15%. An oversize steam drum, oversize fans and extra burner capacity provide the boiler capacity required for quick pick up of full load. An attemperator between the primary and secondary superheaters maintains steam temperature during these rapid load changes required of the plant.

Turbines are conventional 1,800-rpm straight condensing designed for 1,350 psig and 925 F. Station net heat rate at rated load will be about 12,200 Btu per kwhr. Availability dictated choice of the first unit, a modified ASME-AIEE standard rated 60,000 kw, 0.8 pf. Its generator is air-cooled and uses a conventional voltage regulator.

The second unit will have a nominal rating of 80,000 kw at 0.8 pf, cooled by hydrogen at $\frac{1}{2}$ lb pressure. With hydrogen pressure increased to 15 lb the unit will have a capability of 100,000 kw at 0.87 pf. It will be Amplidyne-controlled, with the Amplidyne output in series with the shunt field of the main exciter. Operation of the unit is scheduled for January, 1950.

Power for station auxiliaries is normally supplied through a 7,500-kva station transformer bank. In case of system disturbance this bank is automatically disconnected and the station load transferred to a house unit. This is the first condensing house unit to be used in a PG an E steam station. It is normally operated continuously in parallel with the system through the station transformer bank. Rating of the unit is 6,000 kw at 0.8 pf, with a capability of 7,500 kw at 1.0 pf. Bulk of this capacity is required by 2,000-hp motors driving boiler feed pumps forced and induced draft fans. Normally the turbine carries load in accordance with the demand for steam supplied through its automatic extraction valves to the deaerating heater. Automatic relays allow quick transfer of station auxiliary load to the house unit so the plant may be operated independent of system disturbances. Second house unit will have maximum capability of 10,700 kw at 1.0 pf for the larger auxiliaries which will be required for the second main unit.

Additional steam capacity presently under construction or planned by PG and E totals 800,000 kw. Station P in San Francisco is being expanded by addition of two 100,000-kw units, and two plants with three 100,000-kw units are being designed. Centralized control will be used to the fullest extent in all three cases.



FIRST UNIT is 60,000 kw, 0.8 pf, 1,800 rpm. Availability was prime consideration in selecting 1,350 psig, 925 F turbine, and air cooled generator with conventional voltage regulator. Second unit will be 100,000 kw, 0.87 pf, hydrogen-cooled, Amplidyne-regulated

The Economics of Subtransmission—II

Authors continue economic analysis of various subtransmission schemes. Study idealized application of load-area coverage and distance subtransmission concepts to radial distribution

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and
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IN the previous installment* the authors launched an analysis of subtransmission economics that seeks to make a long-range cost comparison of alternate subtransmission schemes to fit particular conditions. Their approach to the problem has been to conduct a study of ideal conditions through the use of judicious oversimplification.

Five concepts have already been examined. I—Voltage: A group of subtransmission voltages was selected having at least a two-to-one ratio between successive levels, ie: 13.8 kv, 34.5 kv, 69 kv and 138 kv. II—Load Area Size and Pattern: A 20-Mva load area was taken as the minimum basic area load for the study. A plan was established to examine loads up to a maximum of 80 Mva by coupling together 20 Mva areas to form; (1) larger areas of fairly uniform load and (2) non-contiguous 20-Mva areas served from the same source. III—Influence of External Source-System: Identical source-system costs were assumed initially for each of the selected voltages. "Source-system cost" was considered to include generation, transformation and switching costs behind the take-off point for subtransmission circuits. IV—Transmission-Subtransmission Borderline: Here the limitations of serving the maximum 80 Mva area load at transmission voltages at and under 138 kv were examined; V—Substation Size and Arrangement; Substation layout and sub-assembly costs were developed to meet requirements external to the substation. Basic substation building blocks for 13.8- and 34.5 kv output were developed for various area loads up to 80 Mva.

Taking up the analysis from this point the authors next consider:

* ELECTRICAL WORLD, September 11, 1948, page 93.

VI—Idealized Application of Radial Distribution. The cost of component elements entering into subtransmission fall broadly into: (1) Costs of circuits that cover the load area and that for any particular pattern vary with load density and (2) Costs of all other elements essentially independent of load density.

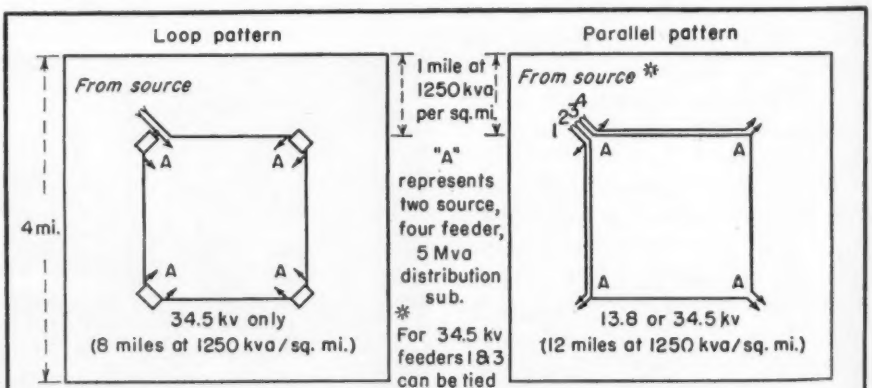
(A) 20 MVA LOAD AREA COVERAGE

Area coverage cost for a 4-mile square area having a load density of 1,250 kva per sq mi is given in Fig 5. For reliability two independent sub-transmission sources are provided to each of the four radial distribution substation serving the area. Two patterns for the subtransmission system will be considered:

1. *Loop Pattern for 34.5 kv.* Since a single 34.5 kv circuit can carry the total load during the emergency, one circuit is looped through each substation and one 34.5 kv breaker is used at each substation.

2. *Parallel Pattern For Both 34.5 and 13.8 kv.* No high-side breakers are used at any distribution substation (Fig 5). The two-source requirement demands the same circuit length for both 13.8 and 34.5 kv, with a decrease in 34.5 kv circuit costs due to lower losses and the possible use of smaller conductors.

Since for all patterns the cost of area-covering circuits (for the same total load) varies inversely as the


Loop pattern
Parallel pattern
From source
A
4 mi.
34.5 kv only
(8 miles at 1250 kva/sq. mi.)
1 mile at 1250 kva per sq. mi.
"A" represents two source, four feeder, 5 Mva distribution sub.
* For 34.5 kv feeders 1 & 3 can be tied together as can 2 & 4
From source *
1
2
3
4
13.8 or 34.5 kv
(12 miles at 1250 kva/sq. mi.)

Relative cost/kva at 1250 kva/sq. mi.

Loop			Parallel			
34.5 kv	34.5 kv	Costs independent of	Overhead		Cable	
Overhead	Cable	load density	13.8 kv	34.5 kv	13.8 kv	34.5 kv
$3.20	$3.20	34.5 kv loop breakers	$0	$0	$0	$0
1.20	1.20	Extra cost of 34.5 kv distr. sub building blocks "A"	0	1.20	0	1.20
3.05	10.95	Cost of area covering circuits (vary inversely as √load density)	5.50	4.40	11.55	16.30
Total $7.45	$15.35		$5.50	$5.60	$11.55	$17.50

FIG 5—LOOP AND PARALLEL COVERAGE patterns for 4-mile square overhead or underground 20-Mva load areas

square root of density, costs will double for ¼ density or 310 kva per sq mi and be halved for 5,000 kva per sq mi. Fig 6 gives the cost for overhead as a function of load density. The 34.5 kv loop pattern is more expensive except for very light load densities. The lower cost 13.8 and 34.5 kv parallel patterns are essentially equal.

The underground picture (Fig 7) is quite different. For it 13.8 kv has a decided advantage at all densities.

With departure from the idealized *square* 20 Mva area, 34.5-kv area coverage becomes relatively more attractive. But, no attempt will be made to evaluate this tendency as it is minor for moderate departures from a square configuration.

For extremely low densities the 1,250 kva circuit loading of each distribution feeder is generally impractical. However, densities of 200 kva per sq mi become sensible if viewed as four 5,000-kva load areas each having about 1,000 kva per sq mi load density but so separated that the average density of the overall area is 200 kva per sq mi. Since such areas are generally served by overhead construction, the 34.5-kv loop pattern is particularly attractive.

(B) DISTANCE SUBTRANSMISSION TO THE 20-MVA LOAD AREA

While two circuits can handle subtransmission from source to load area at 34.5 kv (with either a loop or parallel pattern inside the area), four circuits are required with 13.8 kv. Therefore as distance between load area and source increases the economic position of the 34.5 kv system is improved. Each mile adds:

Kv	Number of Lines	Cost/Kva Overhead	Cable
13.8	4	$2.05	$4.00
34.5	2	$0.90	$2.80

Whether the distance is covered overhead or by cable the 34.5 kv advantage per mile is important; $1.15 or $1.20 per kva.

(C) AREA COVERAGE SIMPLIFICATIONS

1. *Area Coverage with Overhead.* In this study 13.8 kv overhead can be tentatively discarded since it offers little saving inside the area at any density. Moreover, its distance subtransmission costs are at least $1.15 per kva mile higher than 34.5 kv.

2. *Area Coverage With Cable.* By using the 34.5 kv area coverage that has least cost (Fig 7 parallel pattern at heavy densities and loop pattern at light densities) an important simplification can be made which introduces little error (a maximum of 50¢ per kva, 500 to 10,000 kva per sq mi). Regardless of load density, area coverage costs are $3.50 per kva more with 34.5 kv than with 13.8 cable (Fig 7).

(D) 40 AND 80 MVA LOAD AREAS

1. *General Case with Either 13.8 or 34.5 kv Subtransmission.* Neglecting proximity and assuming that these larger 40 and 80 Mva load areas are composed of independent 20-Mva areas each supplied by either two 34.5-kv or four 13.8-kv circuits from the source-system, costs are these:

(a) Overhead 34.5 kv Inside and Outside the Area

Total $/kva = ($0.90 x d) + C_1

where

d = average subtransmission distance (miles) from source to 20 Mva load area

$0.90 = overhead subtransmission distance cost per kva-mile

C_1 = 34.5 kv area coverage cost from Fig 6

(b) Cable 13.8 kv Inside the Area and Overhead Outside

Total $/kva = ($2.05 x d) + C_2

where

C_2 = 13.8 kv area coverage cost from Fig 7

(c) Cable 13.8 kv Inside and Outside the Area

Total $/kva = ($4.00 x d) + C_2

(d) Cable 34.5 kv Inside and Overhead Outside the Area

Total $/kva =
(same as b) + ($3.50 — $1.15 d)

(e) Cable 34.5 kv Inside and Outside the Area

Total $/kva =
(same as c) + ($3.50 — $1.15 d)

It is apparent from the quantity ($3.50 — $1.15 d) that regardless of load density, size of load (as long as it is at least 20 Mva), or proximity of load areas, 13.8 kv is economically limited to cable area coverage cases where subtransmission distances outside the area do not exceed 3.50/1.15 or 3 miles. Technically this applies only within the limits of the previous assumption that source-system costs are equal for 13.8 and 34.5 kv. Actually source-system costs are generally no higher for 34.5 than for 13.8 kv. Exceptions are extremely small isolated systems, such as municipalities.

2. *40 Mva Load Area — Loop 34.5 kv Patterns.* Since two 34.5-kv circuits can handle 40-Mva of load, with one circuit out, the reinforced loop possibilities of Fig 8 give further advantage to 34.5 kv subtransmission when two 20-Mva areas are contiguous. Double loop patterns A_1 and A_2 represent the general-case solution

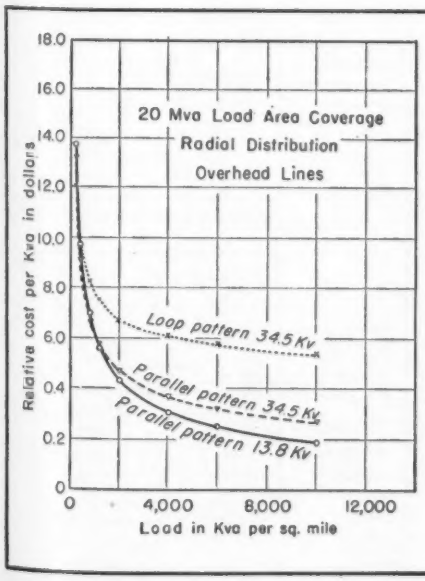


FIG 6—**RELATIVE COST** of overhead 20-Mva load area parallel and loop coverage with 13.8 kv and 34.5 kv

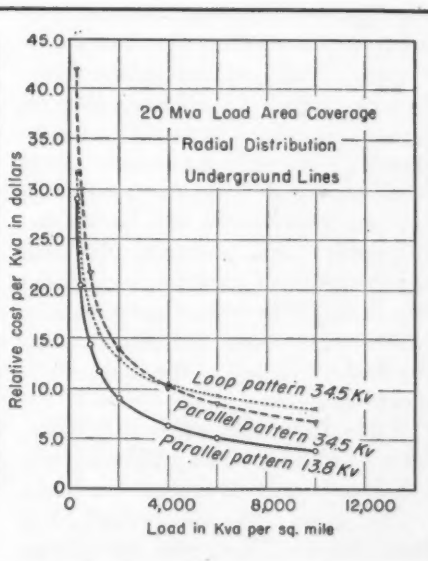


FIG 7—**RELATIVE COST** of cable 20-Mva load area parallel and loop coverage with 13.8 kv and 34.5 kv

and treat the area as two independent 20-Mva areas whereas B_1 and B_2 serve the total load with one reinforced loop.

With overhead coverage (A_2 vs B_2) the reinforced loop advantages are not significant. There are none until load density is as low as $(30/80)^2$ x 1250 or 175 kva per sq mi.

With cable the reinforced loop is usually not important so far as area coverage is concerned. The 40-Mva reinforced loop area-coverage differences which were neglected in the simplification are:

	Savings		Extra Costs		
Kva/sq mi	500	1250	3,500	6,000	10,000
$/kva	$1.20	0.50	0	$0.85	$1.85

Cable is seldom needed at light densities where the reinforced loop has its principle benefit.

The only important advantage for the reinforced loop results from the distance savings where, for some reason, the circuits from the source to the load area must be cable; 3 cables for 40-Mva cost $2.20 per kva-mile and four cost $2.80 as will be shown later. A saving of $0.60 per kva-mile can sometimes be significant and justify the reinforced loop.

3. *40-Mva Load — 13.8 kv Area Coverage Limitations.* If 34.5 kv is used, it may be reasonable to treat contiguous 20 Mva areas as one 40 Mva area. However, when 13.8 kv is used, the problem is entirely different; it becomes necessary to avoid its distance disadvantages, if possible.

The configuration of Fig 8 can be used to illustrate these 13.8 kv limitations. A_1 or B_1 (where the area is served from the short side) is particularly bad. To reach the outer 20 Mva area at 1,250 kva per sq mi requires 4 miles of distance coverage which exceeds the 3 mile economic limit earlier established. This 3 mile economic limit is not attained until load density reaches $(4/3)^2$ x 1250 or 2200 kva per sq mi. If practical from an overall standpoint, a separate 13.8 kv source substation must be provided within the outer 20 Mva area.

A_2 or B_2 is not so bad because the area is served from the long side. If the source substation is well inside the area, one mile (at 1,250 kva per sq mi) distance coverage is required for each 20-Mva load area. The $1.15 kva resulting disadvantage compared to 34.5 kv is important but not prohibitive.

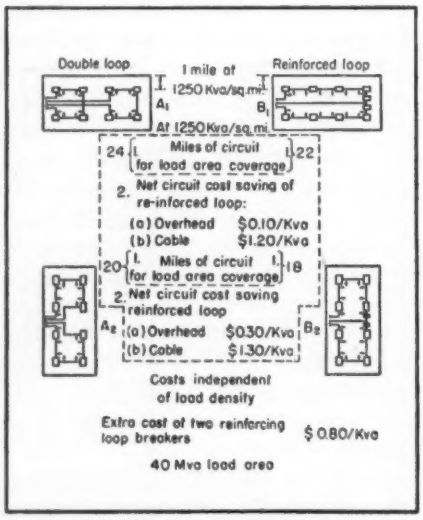


FIG 8—AREA coverage patterns for serving two contiguous 20-Mva areas at 34.5 kv

4. *Distance Subtransmission from Source to 80 Mva Load Area and Dual Voltage Subtransmission.* For 80 Mva overhead 69 kv and 138 kv can cover the distance from source to load area much more economically than 34.5 kv. However, they are generally impractical for "load area coverage". Consideration must therefore be given "dual voltage subtransmission" with intermediate transforming stations in the vicinity of the load area and with the load area covered at 13.8 kv or 34.5 kv.

Usually the distance between source and load area can be covered overhead. The approximate picture which results from the circuit loading data of Table I of the first installment is:

Table II verifies again the limitations of 13.8 kv. Two 138-kv circuits can supply a 20-Mva area for $2.05 — $1.50 or 55¢ per kva-mile less than 13.8 kv. Thus, with 69/13.8 kv or 138/13.8 kv dual-voltage subtransmission this 13.8 kv limitation can be partially avoided. It can be done by using 20-Mva intermediate substations in instances where high tension overhead circuits can be brought to or within each 20-Mva load area.

TABLE II—Cost Per Kva-mile—Overhead Distance Subtransmission

	13.8 Kv		34.5 Kv		69 Kv		138 Kv	
MVA	No. of Circuits	$	No. of Circuits	$	No. of Circuits	$	No. of Circuits	$
20	4	2.05	2	.90	2	1.15	2	1.50
			3	.80				
40	8	2.05	4*	.90*	2	.65	2	.80
			6	.80	3	.55		
80	16	2.05	8*	.90*	4*	.65*	2	.45

* With two circuits per tower, the 3 and 6 circuit advantage disappears; i.e., 4 and 8 circuit costs are 80¢/Kva mile at 34.5 Kv and 4 circuit costs are 55¢ at 69 Kv.

This picture is different with 138/34.5 kv dual-voltage subtransmission. The tendency must be toward at least 40-Mva intermediate substations. At 20-Mva the 34.5 kv distance subtransmission costs ($1.50 — $0.90) or 60¢ per kva-mile less than 138 kv. An additional 70¢ per kva can be saved by using one 40-Mva station rather than two 20-Mva stations. (See Fig 3 of previous installment.)

5. *The Ideal Case for Dual-Voltage Subtransmission.* Consider the case of an 80-Mva load area some distance from the source. Fig 9 shows alternate solutions. Fig 9 (a) is the ideal 138/13.8 kv dual-voltage pattern with minimum 13.8 kv distance, with four 20-Mva intermediate stations and no high-side breakers. Though it is not shown, the 69/13.8

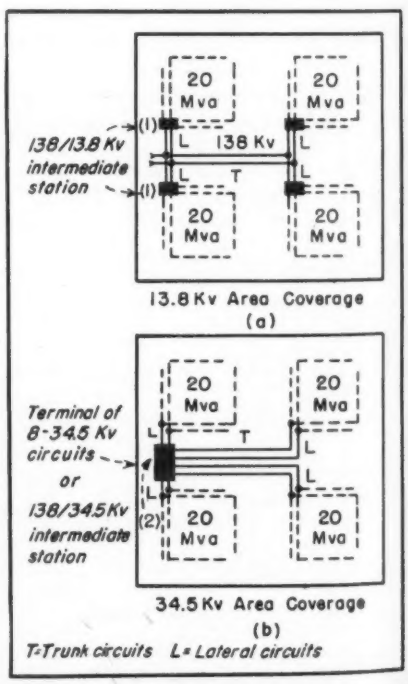


FIG 9—ARRANGEMENT of trunks and laterals to reach four contiguous 20-Mva areas

TABLE III(a)—Cost of Overhead Subtransmission Trunks and Laterals To Reach the Four 20 Mva Areas of Fig. 9

(Load Density 1,250 kva per sq mi)

Item	Dollars per kva of total load 34.5 kv	69 kv	138 kv
4—1 mile laterals each 20 Mva firm power	0.90	1.15	1.50
1—4 mile trunk—40 Mva firm power	1.80	1.30	1.60
Total	2.70	2.45	3.10

TABLE III(b)—Comparison of Single-Voltage 34.5 kv and Dual-Voltage Subtransmission for the Ideal 80 Mva Case

Factor	Dollars per kva relative to single voltage 34.5 kv					
	138/34.5 kv +	138/34.5 kv −	138/13.8 kv +	138/13.8 kv −	69/13.8 kv +	69/13.8 kv −
Cable area coverage saving	0		3.50		3.50	
Intermediate station costs—no real estate—no hi-side breakers (Tables I and II)		7.60**		9.70*		7.60*
Intermediate station losses		1.00		1.00		1.00
Per kva distance saving at 16 mile (Table V, single circuit towers)	7.20		7.20		4.00	
Net extra cost of the dual-voltage at 16 mile ($/kva)		1.40	0			1.10

* 20 Mva stations ** 80 Mva station

kv ideal solution is identical.

Fig 9 (b) uses 34.5 kv to cover the entire 80-Mva area. For dual voltage sub-transmission cases, an 80-Mva substation would be located at (2). In any case for either Fig 9 (a) or (b) the 138-kv or 34.5-kv subtransmission circuits required to reach to the source point of each 20 Mva area vary with load density.

With overhead construction and a load density of 1,250 kva per sq mi their costs are given in Table III (a).

Differences are surprisingly minor although the 65¢ per kva advantage of 69 kv over 138 kv at 1,250 kva per sq mi has a bearing on the relative flexibility of 69/13.8 kv and 138/13.8 kv dual voltage system.

Disregarding these minor variations inside the 80 Mva area eliminates the load density variable and permits simple comparison of the single-voltage 34.5 kv and dual voltage systems. Such a comparison indicates that 34.5 kv covers both areas and distance so effectively that the dual voltage system cannot compete with the single-voltage (90¢ per kva mile) 34.5 kv unless distance to the area exceeds 16 miles. This is true even with cable load area coverage and ideal intermediate station sites which might be reached without forcing the high-voltage lines underground. Under these most favorable conditions, a comparison of single voltage 34.5 kv and dual voltage possibilities may readily be made as in Table III (b).

With overhead "load-area coverage" inside each 20 Mva area the $3.50 cable load area coverage saving disappears and the 138/34.5 kv system becomes the lowest cost competitor to the single-voltage 34.5 kv system. The break even distance of the 138/34.5 kv versus single-voltage 34.5 kv becomes 19 miles.

Table III (b) which neglects double circuit tower construction, for reasons that will be apparent later, may be condensed into the form of Table III (c).

6. *Load Area Coupling—its Influence on Dual Voltage Subtransmission.* The term "coupling" means the interconnection of 20 Mva load areas so that the greatest cost advantage can be realized from the combination of (a) distance covering circuits from the source, (b) intermediate station or stations and (c) the 13.8 or 34.5 kv circuits from the intermediate stations to the 20 Mva load areas.

This coupling problem for the dual voltage system becomes more difficult as the separation of load areas increases. But it is least difficult for the 80 Mva contiguous load area of Fig 9 where coupling cost differentials in trunks and laterals can be neglected.

The most extreme 80-Mva dual-voltage coupling problem occurs when four widely separated 20-Mva areas are located on the circumference of a circle with the power source at the center. The radius becomes the subtransmission distance for 34.5 kv but the distance between areas will be greater than the distance to the source when the spacing exceeds one radian. Coupling among such areas is uneconomical.

This coupling problem is similar to the 20-Mva load area coverage previously evaluated. But its variations and ramifications make simplified evaluation seem impractical. However, certain rational patterns can be studied for major changes.

Fig 10 illustrates the fairly extreme condition when four 20 Mva areas are equally spaced along the base of an equilateral triangle. Each area would require two 34.5 kv circuits radiating directly from the apex or power source.

When the distance to the upper load area is 18 miles, the spacing between centers of load areas is 6 miles. As distance to load area varies, the pattern becomes inapplicable to short distances, unless load area density is high. At 12 miles, the spacing is 4 miles and the pattern is meaningless at densities under 1250 kva per sq mi because each area would then be greater than 4 miles square.

As might be expected the 138 kv dual voltage systems have the greatest coupling handicap even though the 138/34.5 kv pattern (A_1) retains

TABLE III(c)—Ideal Dual-Voltage Subtransmission

	138/34.5 Kv	138/13.8 Kv	69/13.8 Kv
Area Coverage	O. H. or cable	Cable only	Cable only
EC_d	$8.60−.45 d	$7.20−.45 d	$5.10−.25 d
EC_{16}	$1.40	0	$1.10

where
EC_d is the extra cost (over single voltage 34.5 K.V.) at d miles from source, and
EC_{16} is the extra cost at 16 miles
All circuits to load areas are overhead.

TABLE IV—Cost per Kva Mile Cable Distance Subtransmission

MVA	13.8 Kv No. of Circuits	13.8 Kv $	34.5 Kv No. of Circuits	34.5 Kv $	69 Kv No. of Circuits	69 Kv $
20	4	4.00	2	2.80	2	4.50
40	8	4.00	3	2.20	2	2.30
			4	2.80		
80	16	4.00	6	2.20	3	1.80
			8	2.80	4	2.30

21¢ of its previous 45¢ per kva mile distance saving. The 138/13.8 kv system, previously as good as any, now becomes the highest cost dual voltage system.

Fig 11 (a_1 b_1 and c_1) probably represents a fairer geometric basis for general comparison. Here the relationship between source and the two nearest load areas is exactly the same as in Fig 10. However, the base of the triangle has been folded over away from the source so that the four areas now form a square. Coupling in this case, however, is relatively just as difficult as in Fig 7 if we inject the double circuit tower construction for the single voltage 34.5 kv system. That construction could be used in each of the first two load areas with negligible increase in circuit mileage and an overall reduction of 8¢ per kva mile.

Where the base of the triangle of Fig 10 is rotated 90°, then the load can be served on a straight line from the source station (Fig 11, a_2 b_2 c_2). In this case the 138/13.8 kv system becomes reasonably attractive but with cable in the load area, the 69/13.8 kv system appears to be the most economical dual voltage system throughout all three patterns of Figs 10 and 11.

In considering any of these 69/13/8 or 138/13.8 kv patterns, $3.50 must be added to their relative costs wherever load area coverage can be largely overhead. But if overhead is possible any cost advantage of the 138/13.8 kv over the 138/34.5 kv system completely disappears.

Nowhere, within a load center distance of 25 miles in the patterns of Fig 9, 10 and 11 does subtransmission dictate to depart from the single voltage 34.5 kv system. Justification for any such change must come from within the external source system.

7. Cable Distance Subtransmission and Load Area Coupling. Congestion and right-of-way difficulties in large metropolitan areas can readily distort this coupling analysis. Circuitous overhead can become so costly as to force the distance subtransmission largely underground. Several significant comparisons can readily be made;

(a) Two 69 kv laterals to feed a 20 Mva intermediate station cost $1.70 per kva mile more than single voltage 34.5. For overhead that difference is only 25¢ per kva mile.

(b) For 40 Mva, the 69 kv costs 10¢ per kva mile more than 34.5 kv; with overhead it is 15 to 25¢ per kva mile less.

It is apparent therefore that if the same area coupling problems are encountered in feeding an 80 Mva load with cable as were encountered with overhead, the single voltage 34.5 kv will appear still more advantageous. Actually, however, this additional advantage seldom materializes. The cable distance requirement should mean higher densities, adjacent load areas and easier coupling conditions.

In the concluding installment of this article, to appear in the next issue of ELECTRICAL WORLD, the authors will discuss;—VII Variations with Distribution Networks and VIII The Correlation of Subtransmission and External Systems.

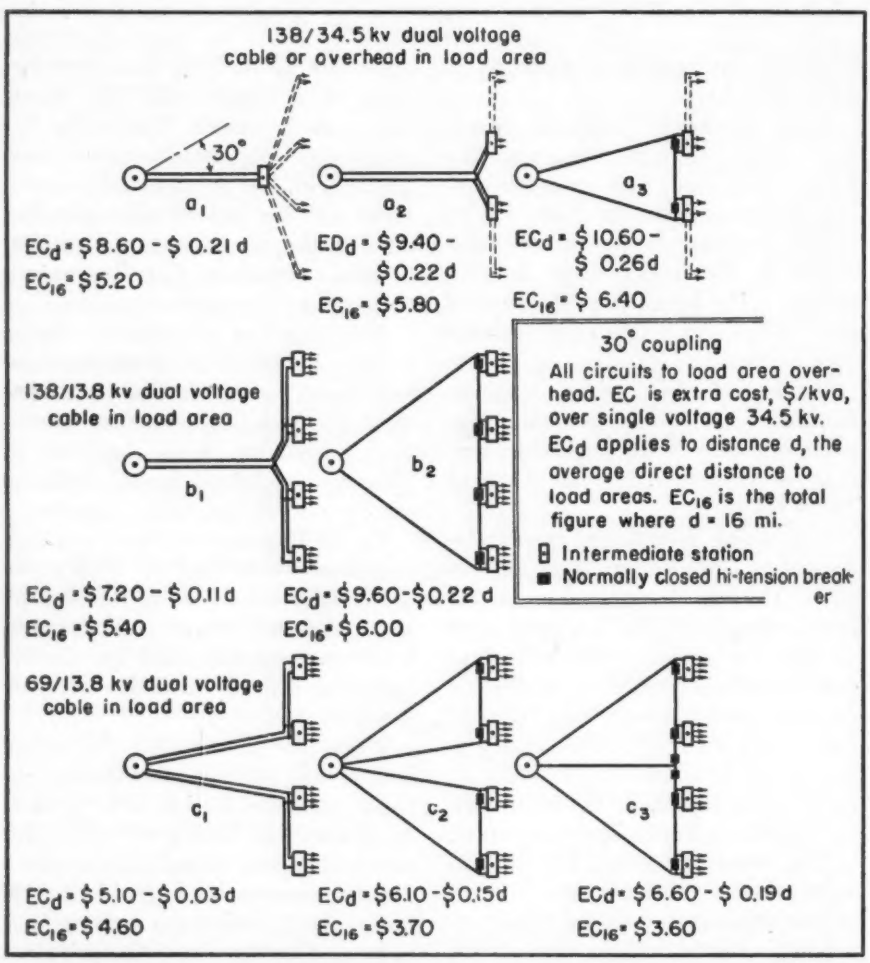

138/34.5 kv dual voltage
cable or overhead in load area
30°
a_1
a_2
a_3
EC_d = $8.60 - $ 0.21 d
EC_{16} = $5.20
ED_d = $9.40 - $0.22 d
EC_{16} = $5.80
EC_d = $10.60 - $ 0.26d
EC_{16} = $ 6.40
138/13.8 kv dual voltage
cable in load area
b_1
b_2
30° coupling
All circuits to load area overhead. EC is extra cost, $/kva, over single voltage 34.5 kv. EC_d applies to distance d, the average direct distance to load areas. EC_{16} is the total figure where d = 16 mi.
Intermediate station
Normally closed hi-tension breaker
EC_d = $7.20 - $ 0.11d
EC_{16} = $5.40
EC_d = $9.60 - $0.22 d
EC_{16} = $6.00
69/13.8 kv dual voltage
cable in load area
c_1
c_2
c_3
EC_d = $ 5.10 - $0.03d
EC_{16} = $4.60
EC_d = $6.10 - $0.15d
EC_{16} = $3.70
EC_d = $ 6.60 - $ 0.19d
EC_{16} = $ 3.60

FIG 10—LOAD AREA COUPLING patterns when four 20-Mva load areas are equally spaced along the base of an equilateral triangle

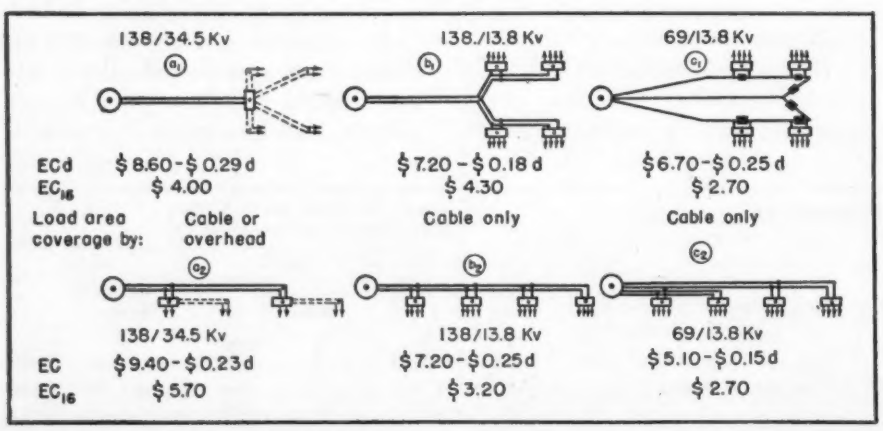
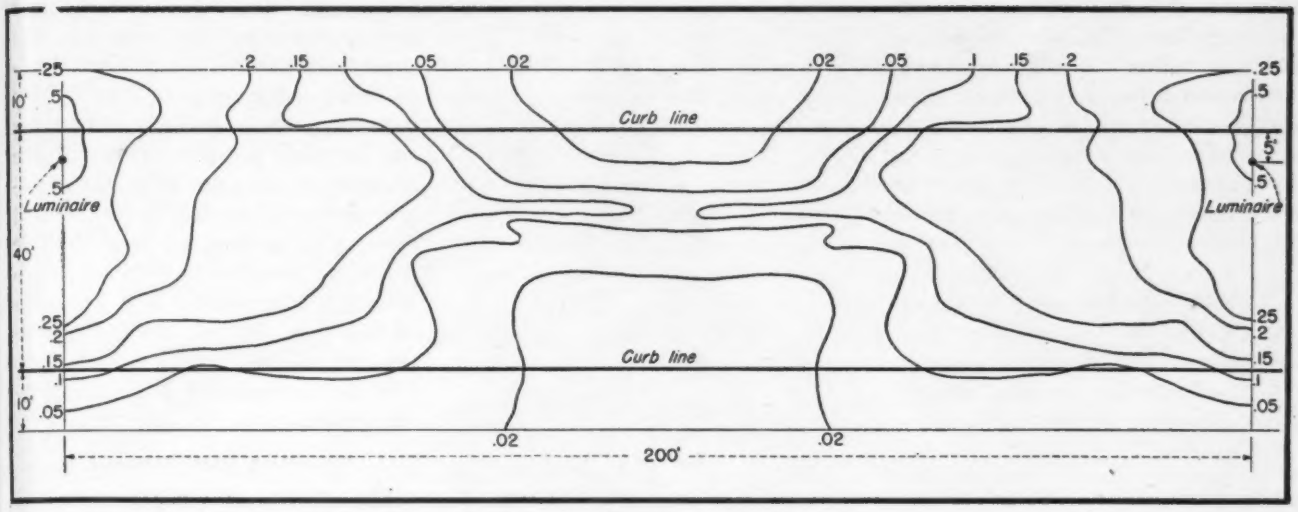


FIG 11—COUPLING PATTERNS when 20-Mva load areas form a square or are in line



LIGHT DISTRIBUTION on road surface from 2,500-lumen PAR-38 refractor-lamp unit

Sealed-Beam Lamps for Street Lighting?

Experiments with new unit-design of reflector, refractor and lamp offer municipalities modernization—Economic studies needed to determine practicability of new idea

R. G. SLAUER and WILLARD ALLPHIN*

CAN THE SEALED-BEAM type of lamp of automobile headlighting fame be used for street and highway lighting? The objective is the same in each case, lighting a few hundred feet of narrow, poorly-reflecting pavement. Essentials for a suitable unit are: (1) good carrying power up and down the road; (2) no wastage of light at high angles and off the road; (3) no glare at high angles; (4) resistance to malicious breakage.

A logical design combines lamp, reflector and refractor in one unit, to be built on a mass production basis. Such a development has been achieved experimentally in the so-called PAR-38 lamp. Within a year it may be available for general street lighting in the 1,000 and 2,500-lm classes. Higher ratings may come later. Samples of the final design are now available to those interested.

Such a lamp offers most of the advantages and avoids some of the disadvantages of a large reflector-refractor assembly. No tower truck is needed. Relamping is by picker from the ground. Cleaning is eliminated by providing a new reflector and refractor with each lamp. As a target, the PAR-38 is the despair of the small boy. It is small, heavy in construction, and shaped to deflect stones or BB shot on oblique hit.

Features of Unit Design

With such a unit, orientation reduces to an easy house-side vs. street-side identification. The only possible error in installation is a full 180 deg rotation, quickly apparent if made. The integral combination includes the standard film cutout. The general shape is spherical and the hard glass is thick. Sealing is hermetical. Some glare reduction is obtained because the apparent light source is larger than the filament of a bare lamp in a radial-wave reflector. To avoid glare at high angles from the nadir the band of maximum output does not extend above 75 deg and the principal cut-off is at 80 deg. Even with these characteristics the new lamp may seem somewhat more glaring than a radial-wave unit to an observer viewing it from, say 70 deg. But it should be realized that under such conditions the PAR-38 is delivering much more light to the roadway. The number of lumens at the spot where the observer is standing is necessarily greater from a source that is delivering more light right there.

The first sample of the new unit was demonstrated in Boston early this year. The most important change effected by the lamp was the redis-

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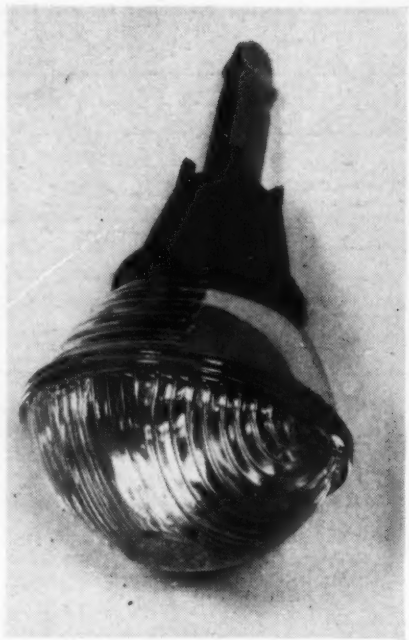
tribution of light flux from outside the curb line (i.e., on lawns and building fronts) to the main pavement beam between curb lines. Lens and filament modifications are partly responsible, but reflector control is the primary factor. This may be seen in the picture of the lamp; above the maximum diameter is a row of parallel lens ribs. This feature, combined with better control of maximum upper cut-off, a more definite maximum beam, and the elimination of certain casual light streaks, resulted in the isolux curve illustrated.

In rating, the design follows ac-

Ratings as Luminaires

cepted practice. Output is perhaps 80 percent (800 and 2,000 lm respectively). This is consistent with luminaire efficiencies ranging from 50 to 80%. A composite lamp such as this is in reality a luminaire rather than a simple light source. It would be possible to increase the rating so that delivered output would equal nominal, but this would mean higher input through higher voltage drop for a given current rating. Hence for preliminary work, luminaire practice rather than lamp practice has been followed. Rates and contracts for street lighting are in general based on nominal lumens instead of delivered footcandles.



NEW STREET LIGHTING UNIT (PAR-38) with integral reflector, refractor, filament and film cut-out, development stage

Purchasers will make the final decision on size limitations, but preliminary field tests indicate that 1,000 and 2,500 lm are probably logical for the new design. Below 1,000 lm the extra cost of incorporating reflector and refractor in the lamp may perhaps be unjustified, although this should not prevent a 1,000-lm. PAR-38 from replacing a 600 or 800-lm bare lamp where an increased charge can be made for the service. If the filament becomes too large, the necessary degree of control is lost, and it remains to be seen whether multiple connected lamps with their larger filaments can provide a field for units of this type. So far, the indications are that a 4,000-lm unit may be outside the economic range of the present design.

Orienting Base Required

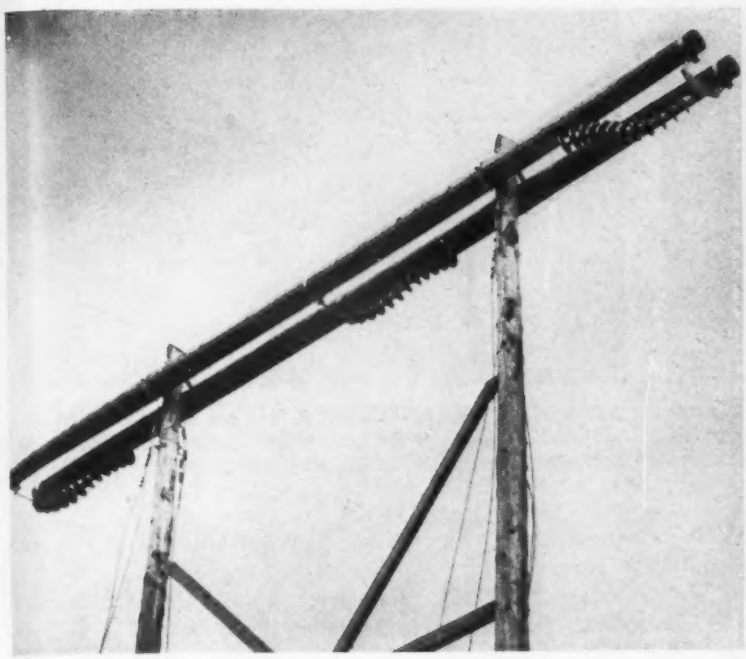
The screw base used for convenience in the laboratory models of the PAR-38 gave way early to the prong base. It would not be feasible to make the base so that it would screw just so far into a removable socket, as there would be no assurance that the principal beams would be directed properly when the socket was pushed into its receptacle. An oriented base is essential, perhaps with an embossed symbol on the lamp to indicate the house or street side.

In the usual range of highway lighting, say from $20 to $40 per pole per year, the field for experimentation is economically limited. The hard glass reflector type of lamp would cost several times a standard lamp and its cost would be repeated at each burnout. The strength of the PAR bulb is valuable, and in some communities would cut maintenance or replacement costs enough to turn the scale. The integral cut-out might permit salvage economies. Cleaning operations are done away with and decreased lighting efficiency due to reflector corrosion is impossible.

Sights Set Too Low

The general public and its representatives in public office look upon $2 per capita per year as a generous allowance for street lighting. It is difficult to make them see that reasonable additional cost is more than offset by savings in life and property. So long as these conditions exist, so also exists the problem of lighting perhaps 8,000 sq ft of ribbon-like road with a wattage not much more than that in a pair of residential entrance-way brackets. The PAR design is a new thing to consider towards solution of this problem.

TRIAL INSTALLATION at Boston of 1,000-lumen PAR 38 lighting units



SPAR-TYPE WOOD CROSSARM construction, developed during the war, used on Chehalis-Olympia 230-kv wood pole line

H-Frame 230-Kv Wood Pole Crossarm Design Practice

Some war and post war experiences with crossarms of timbers, spars and aluminum for H-frame, 230-kv wood pole construction. Comparative costs are given

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Bonneville Power Administration
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THE CROSSARM is a very critical member in a vigh-voltage transmission line structure. For this reason, crossarm design, including the choice of materials for it, is of great importance in determining the very nature of transmission line structures. During normal periods, choice of materials for the crossarm and its resulting design is influenced by a number of factors. Among these are the type of conductor and conductor loads to be supported; the desired electrical characteristics of the structure and the line, especially as related to lightning protection and radio-noise reduction aspects of the job; and the economies involved.

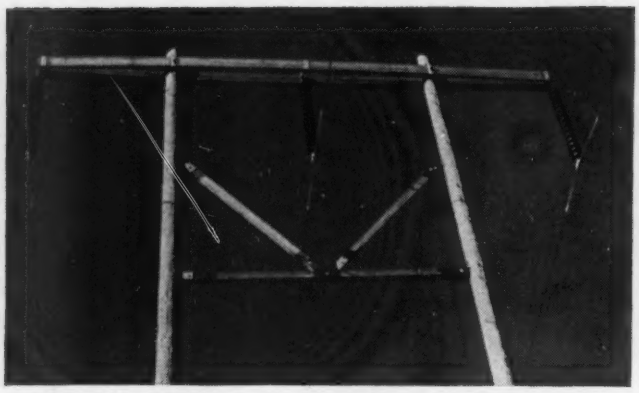
Shortage of materials during the war and the early post-war period, rather than considerations of design and economy, imposed upon the Bonneville Power Administration the need of designing and constructing 230-kv transmission lines with wood poles and a variety of crossarm materials rather than with the efficient, economical and time-tested steel towers of types long since adopted by the industry. Since the Administration's experience ranges from full length plank arms, spliced plank arms, spar arms and even aluminum channel crossarms, this experience may be of value to the industry.

Particularly difficult was the Administration's first case. Early in the war it became necessary to build a second 230-kv circuit from Grand Coulee Dam to Covington, in the vicinity of Seattle. The first line on the two-line right-of-way, was built with single-circuit steel towers of the "rotated" type. The line traverses rugged country, heavily wooded at higher elevations, particularly through the Stampede and Colockum Passes in the Cascade Range.

Steel Shortage Prompts Change

When it appeared obvious that steel would not be available for the entire length of the second circuit of this line, it became necessary to design a wood pole structure which would, with safety, serve as somewhat a match to the steel towers of the first circuit. Naturally, the design had to be conservative in order to withstand wind-design conditions, and capable of supporting long spans dictated by the topography of the region.

The resulting design was a true truss-type double-crossarm in which



WOODEN TIMBERS 36 ft long used for 230-kv crossarms. Spacer blocks 7½ x 9½ in. are identically drilled in two planes to permit use with pole tops varying from 8 to 10 in. in diameter

ALUMINUM CHANNELS 40 ft long are placed back to back and used as substitute for wood timber crossarms on 230 kv line. Galvanized steel cable hanger employed to increase rigidity

the main load-carrying lower chord was built up of Douglas Fir timbers having the nominal 4 in. x 8 in. cross-section. To accommodate the phase-to-phase spacing of 22 ft, which was considered to be the minimum for this line, the overall length of the crossarm had to be 46 ft. It was pretty near impossible to find single timbers of that length and size in the grades specified. For this reason it was decided to build up the crossarm of the two sets of 30 and 16-ft timbers alternately spliced at both ends by timber blocks 6 ft long. These splice blocks, having a finished cross-section corresponding to the nominal 8 x 10 in. dimensions were drilled identically in the two right-angle planes, so that they could be placed between the crossarm timbers, spacing them either at 7½ or 9½ in. depending upon the size of pole tops in the particular structure. To assume safe performance of this built-up crossarm while maintaining the use of a practicable, commercially-available cross-section (in this case 3⅝ x 7½ in. in the S4S finished timbers) it was necessary to complete the crossarm design by giving it a truss-type bracing. This consisted of four single diagonals, made of 3⅝ x 3⅝ in. timbers, each 10 ft 4 in. long, and an upper tension member for which a ⅝ in. galvanized steel cable was used.

Internal Bracing Reduced Guying

Added transverse strength was given the structure by the so-called K-type (and X-type) internal bracing which reduced the use of expensive transverse guying in a great number of cases. Full size tests, to complete destruction, were conducted on structures of this design before it had been perfected and finally adopted. (See ELECTRICAL WORLD, May 26, 1945, p 84) The crossarms were fabricated both of air-dried and urea-spray treated green lumber. Experience to date has proved this crossarm to be sufficiently effective for the severe conditions under which the Covington-Coulee lines operate. But, it is too early to draw any general conclusions as to the effectiveness of this design over the generally expected 25-year life span of wood structures.

230-Kv Unspliced Timber Crossarms

The truss-type, spliced timber crossarm, while effective under especially severe conditions of operation, was considered too heavy, complicated and costly for use in structures operating in more or less ordinary climatic conditions. For this reason a lighter design of crossarms was subsequently developed. This lighter design was made possible when full advantage was taken of the insulating properties of wood in the crossarms with the result that the phase-to-phase spacing of conductors was reduced to 18 ft, instead of 22 ft as was the case in the Grand Coulee-Covington design. The resulting full length of timbers for the crossarms of only 36 ft, was considered readily available even on the war market. The nominal size selected for the crossarm timber was 4 x 10 in (commercially S4S finished to 3⅝ x 9½ in.). Two such timbers were used for a double-arm design in which the creosote treated spacer blocks like the splice blocks in the previous design, were of 7½ x 9½ in. finished section, identically drilled in the two planes normal to each other. This permitted their use with pole tops varying from 8 to 10 in. in diameter. There was no vertical trussing of the crossarm in this design. Transverse stability of the structure was attained by the use of K braces.

Again, the peculiar conditions of the lumber market in the immediate post-war period made it impossible to secure bids for the crossarms of this newly developed lighter design in sufficient quantities to satisfy the need for three projected 230-kv lines. Only through negotiation did it become possible to secure fabrication of these crossarms for one of the lines projected. This line has been recently constructed between Grand Coulee and the vicinity of the proposed Foster Creek Dam in the state of Washington.

Metal Crossarms Studied

It seems that the war cycle of scarcity and the peculiar shortages of the immediate post-war period finally made Douglas Fir timber, ordinarily used for wood crossarms, one of the most critical items in the country. So, while it was still impossible to secure galvanized steel shapes in sufficient quantities to return to steel towers for standard 230-kv construction, the Administration was forced to consider the combination of metal crossarms with wood poles. Peculiarly enough, study and investigation brought out the bold-faced fact that about the only material that could be obtained for crossarm use was, of all things, aluminum. By no means the cheapest in cost and not the most efficient with regard to rigidity, aluminum shapes were of necessity adopted

for use as crossarms for the next 230-kv line that had to be built.

Hence, the 230-kv line from Arlington to Blaine, on the Canadian Border in the state of Washington, has been constructed with aluminum crossarms and internal bracing of the K type. To offset somewhat the lack of rigidity in this aluminum crossarm and to obtain maximum economy through use of smaller shapes, a ½-in. galvanized steel cable hanger was employed. Use of metal, instead of wood, in this structure, demanded that phase-to-phase spacing of conductors be increased from 18 to 20 ft, resulting in a crossarm having a total length of 40 ft.

The crossarm is made up of two 6-in. or 8-in. channels placed back-to-back on both sides of the pole and stitched to each other at about 2½-ft intervals by double-arming bolts. As is the practice in wood pole construction, galvanized steel gain-plates were used to provide proper seating of the crossarms at the pole and to reduce somewhat the vertical loading on through-bolts. Incidentally, galvanized steel gain-plates so placed between the western red cedar poles and the aluminum channels serve also to protect the latter from possible destructive action of wood chemicals.

230-Kv Spar Crossarms

Evolution of 230-kv crossarm design under war conditions finally brought BPA to the present use of a spar crossarm. This crossarm has been designed to have a nominal diameter of 13 in. over the central 21 ft of its 41-ft length, with a nominal end-diameter of 10 in.

It is being turned in an especially designed lathe from Douglas Fir logs and subjected to creosote treatment by empty cell process to a retention of 6 lb per cu ft. The hardware to be used with this crossarm is of the adjustable-band type. This crossarm is being fabricated for the Chehalis-Olympia 230-kv line, now being constructed in the state of Washington.

Laminated Crossarms

In the search for suitable crossarm material, the use of laminated crossarms has also been considered. Laminated shapes were successfully used during the war in a number of applications, such as in ship keels, heavy roof truss members, etc. To check the adequacy of this material for transmission line usage, sample arms (4 x 10 in. x 36 ft) of the 230-kv design were tested; some of these were made of 1 x 10 in. vertical laminations and others of 1 x 4 in. horizontal laminations. Sustained maximum loadings were placed upon a structure built with these crossarms over a period of 16 months and through a cycle of typical northwest weather. They were also subjected to a series of electrical tests. Results obtained were satisfactory and have proven that the glues used were not affected by weather, nor do they produce undesirable electrical effects.

However, the cost of fabricating laminated crossarms is prohibitively high, even if inexpensive grades of lumber can be used in the lamination with perfect safety. Hence, their application on the Bonneville Power Administration system has not been considered for the present.

Costs Per Structure

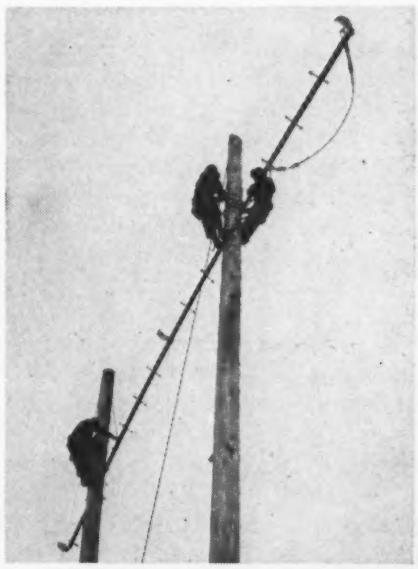
While availability of materials was often the determining factor in choice of crossarm design, rather than cost, nevertheless a comparison of costs will prove of interest to transmission design engineers. The accompanying table gives comparative costs for all the types of arms that have been discussed.

With the return to more nearly normal conditions, it will be possible for the Bonneville Power Administration to resume use of galvanized steel structures for its major transmission lines. To further increase the economy of this type of construction, basic designs are now being developed for new "light" type steel towers, both in the 230-kv and 115-kv fields of construction.

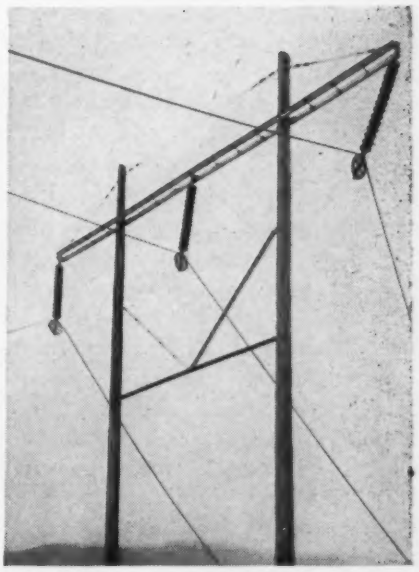
Comparative Costs of Crossarm Designs and Materials for 230-kv H-Frame Wood Pole Lines

Type	Size of X-arm	Date Purchased	Unit Price	No. Per Str.	X-arms Cost Per Str.	Hardware Cost Per Str.	TOTAL* Installed Cost
Spliced	4" x 8" x 30'	11- 8-43	6.07	2			
Plank	4" x 8" x 16'	11- 8-43	2.96	2			
Truss	8" x 10" x 6'	11- 8-43	3.05	2		†	
	TOTAL		12.08	2	24.16	53.66	116.92
Plank	4" x 10" x 36'	11- 8-45	12.90	2	25.80	45.54	108.91
Aluminum	6" (at 2.91 lb./ft. x 39' 11-5/8")	12-26-45	30.314	2	60.63	81.50	222.13
Spar	13" x 41'	6-20-46	65.40	1	71.25	75.00	**211.65

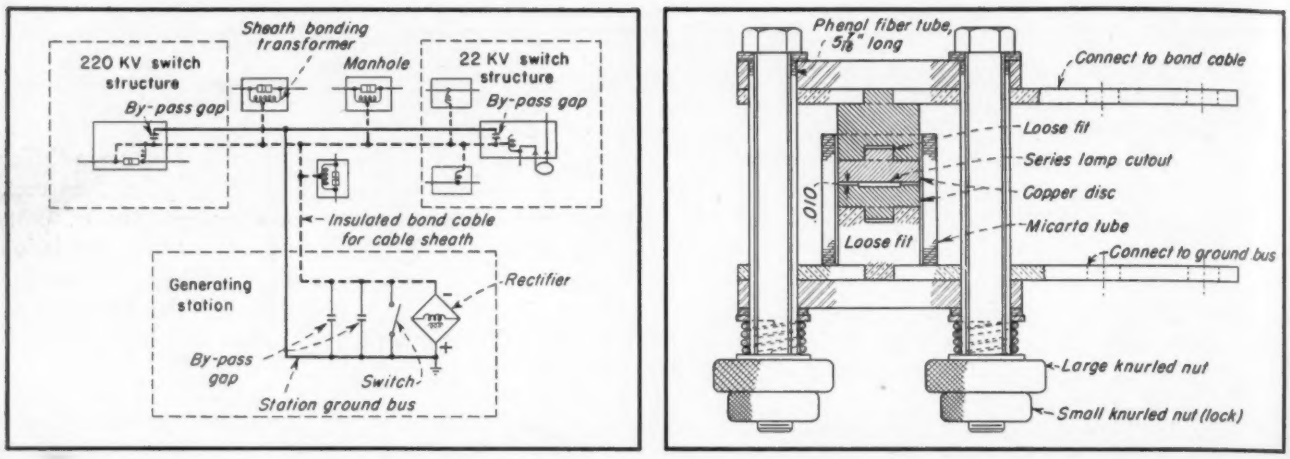
* All costs based on low bids for materials and labor of erection.
** Lines now under construction.
† Balance of truss materials included into "hardware."



INSTALLATION OF ARMS is made easier by their light weight. Double arming bolts will hold channels back to back for rigidity



COMPLETED STRUCTURE with insulator strings attached and conductors in sheaves ready for sagging-in operations to begin



CATHODIC PROTECTION SYSTEM for station and two switch structures utilizes a rectifier, an insulated bond cable, by-pass gaps and a short-circuiting switch. Detail of the by-pass gap, which has a series lamp cut-out as the protective element, is shown at right

Stubborn Cable Sheath Corrosion Problem Defeated

Cathodic protection eliminates cable sheath corrosion resulting from galvanic conditions in soil—By-pass gaps break down and allow passage of current from cable sheaths to ground bus if faults occur

L. F. GREVE
Corrosion Engineer
Commonwealth Edison Co
Chicago, Ill.

A PROBLEM of cable sheath corrosion caused by a large scale galvanic cell was solved despite its unusualness and stubborness. It occurred in one of the company's generating plants which is far removed from any stray electric railway currents. In this case two cables failed and ten others were found to be seriously corroded.

The cable sheaths were connected to copper covered ground rods in each manhole and to a ground bus. The latter consisted of bare copper buried cables which were connected to many 30-ft copper covered ground rods. There were also many bronze armored cables buried in the ground between the station and the transformer terminal. Duct surveys showed the cable sheaths to be as much as 0.6 v positive to earth.

First step in mitigating this condition was to disconnect the copper covered ground rods in the manholes. The second was to apply cathodic protection. However, in this case it was impossible to force current to flow from a ground plate to the cable sheaths because of some reinforcing wire in the concrete envelope around the conduit line. Both the cable sheaths and the reinforcing wire were connected to the ground bus.

In order successfully to apply cathodic protection to the cable sheaths it was necessary to disconnect the cable sheaths from the ground bus and install a rectifier between the cable sheaths and the ground bus as shown left, above. The cable sheaths were connected to an insulated bond cable which was connected to the negative terminal of the rectifier. A short circuiting switch was installed from the bond cable to the ground bus so that the switch may be closed (with the rectifier shut down) while men are working in the manholes. For normal operation the rectifier supplies 2.5 amp at 6.5 v.

In order to provide a path for fault currents, in case of a cable failure, four by-pass gaps were installed at various locations between the bond cable and the ground bus. Details of the by-pass gap appear in the drawing above. These by-pass gap units utilize a series lamp cut-out for the gap itself which is backed up with a heavy copper removable disc. These discs may be replaced if the gap should fuse. Tests indicated that these gaps would blow at 100 v plus or minus 10% when under pressure of 100 lb. The springs shown and the stud insulating bushings with an overall length of $5\frac{7}{16}$ in. can be adjusted to provide the desired pressure.

Since this equipment has been installed there has been one cable failure but this was not due to corrosion. The sheath gaps operated properly and the rectifier was not damaged.

HOW TO DESIGN • CONSTRUCT OPERATE • MAINTAIN

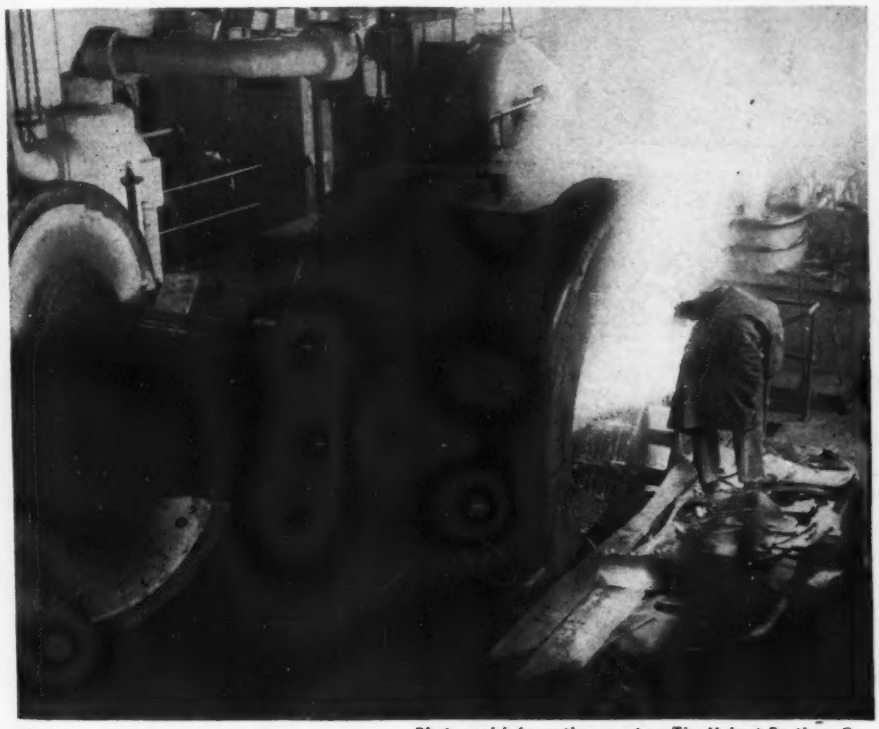


Photo and information courtesy The Hobart Brothers Co

TURBINE-GENERATOR is dismantled by 8 to 10-in. electric arc cuts on top and sides of each end of cast-iron housing. Wedges and a crane pull caused the casting to break. Valve casing, bucket wheels and nozzle plates were cut in half to remove them from the shaft. Complete unit was cut into eight sections and removed in two weeks

Generator Unit Scrapped By Electric Arc Cutting

By the electric arc method an obsolete 3000-kva, turbine-generator unit was dismantled in record time in order that the Central Ohio Light and Power Co could provide space for new steam generating equipment in its station at St. Marys, Ohio. The old 25-cycle unit had given 25 years of successful service before it was condemned in 1946. The Brandman Iron & Metal Co of Findlay, Ohio, had contracted for and been awarded the dismantling job to be completed in a specified time.

It was decided to use the electric arc method for the cutting operation. First, all miscellaneous parts were dismantled. The generator stator windings were cut away and then the steel laminations were pulled loose. The stator housing was then clean for the electric arc cutting operation shown in the illustration. A 300-amp electric drive arc welder was used because it was on the site. However a 400 or 600-amp arc welder would have been better and would have completed the job in less time.

Electrodes used were $\frac{1}{4}$-in. diameter and had a heavy coating and spraying action. By drawing 325 amp on the welder, one 18-in. electrode would make a cut 3 in. long in $1\frac{1}{2}$ min through 1-in. cast iron. On heavier sections of $2\frac{1}{2}$-in. cast iron, one 18-in. electrode would make a cut $1\frac{3}{4}$ in. long in $1\frac{1}{2}$ min. By cutting towards the middle on a line from each end of the housing or casing, it was not necessary to make a complete cut from one end of the housing to the other. Considerable cutting was avoided by driving steel wedges into the cuts and by pulling on the casting with a manually operated crane. From the strain set up the casting would crack.

The generator stator housing was removed in 4 sections and the turbine casing was removed in 2 sections. The complete generator frame was cut and removed in 8 sections. The electric arc was also used to cut other sections such as the valve casing, bucket wheels and other parts that were difficult to disassemble. The complete turbine generator was dismantled in two weeks by one cutting operator and four laborers.

Magnetic Amplifier for Industrial Controls

A new 50/50 nickel-iron alloy Permenorm 5000-Z originated by the Germans has been developed to have unique magnetic properties by experts at the Naval Ordnance Laboratory at White Oak, Md. These characteristics open the possibility that cores made of the material may work well in magnetic amplifiers with the sturdy characteristics needed for industrial controls.

What could ordinarily require a tube can now be performed by simple magnetic amplification. This potentiality rests on the vertical, rectangular, sharp-kneed hysteresis loop (Fig 1) that can be imparted to the alloy under carefully regulated conditions of purity, heat treatment and avoided mechanical strain.

In using Permenorm 5000-Z for amplification purposes the tapes are of 0.0012 to 0.002 inch thickness and width 0.014; the closed annular core and ampere-turns are so proportioned, relative to the power to be controlled, that at zero control current the core does not become satu-

A Package OUT OF THE BOOK

ORDERED AND INSTALLED AS ONE COMPLETE UNIT

Only one order and one set of specifications were needed f
the equipment of the above substation. Transformers, switchgear,
work, lightning arresters, disconnects—everything but the conduit,
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This eliminated months of costly "piecemeal" planning—m
possible to place the order without delay. It made installation
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assembled sections as large as shipping facilities permitted.

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frees system engineers of much detail work on components, le
concentrate more profitably on over-all system operations.

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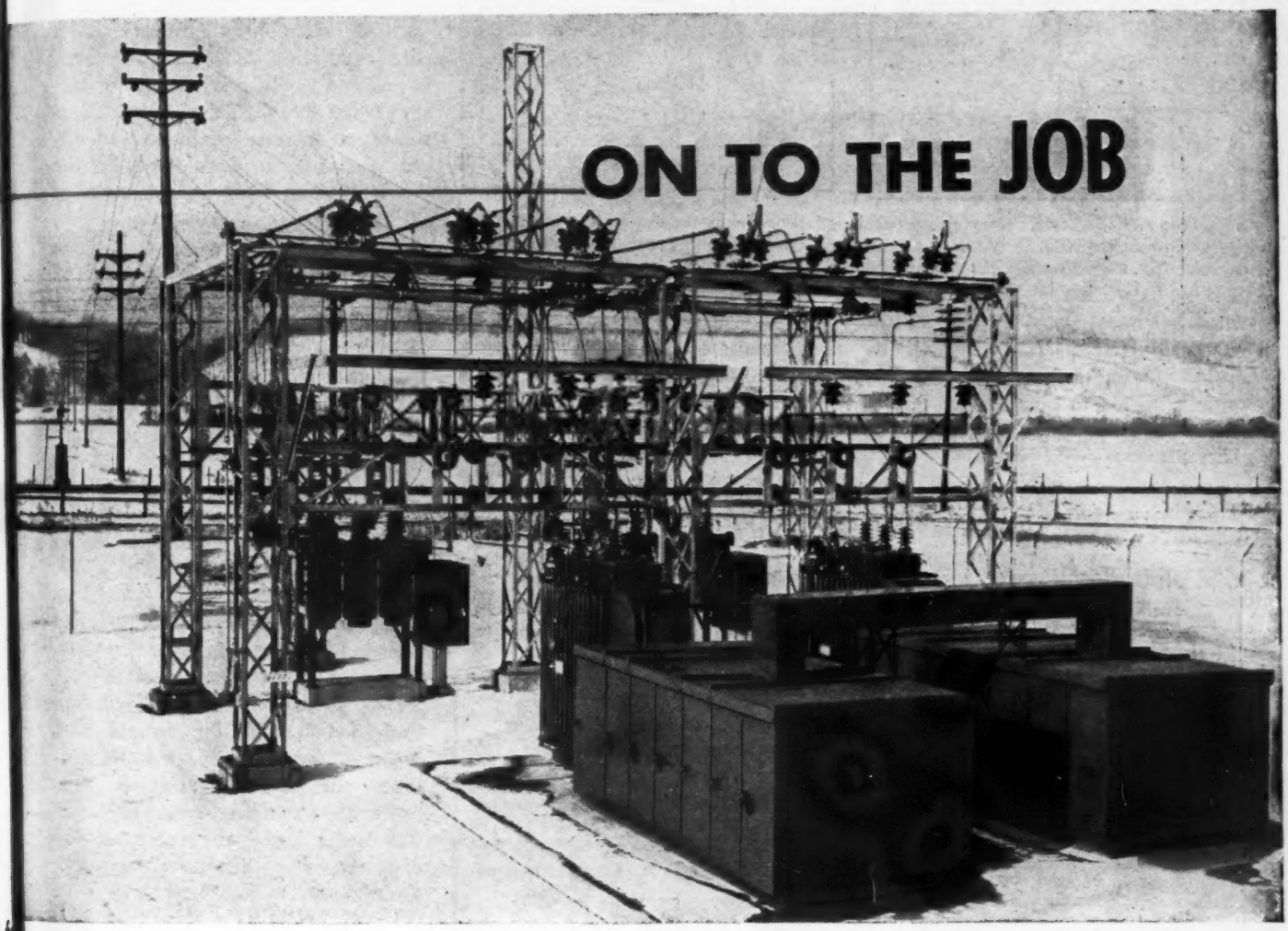
Two years ago G.E. introduced the "Package Substation" as one of the solutions to the difficult economic and manpower problems facing the electric utility industry. The unusual acceptance of the idea is indicated by the fact that over 500 of these complete package substations have been purchased by electric utilities since publication of our package substation bulletin (GEA-4500) two years ago.

Substation . . .



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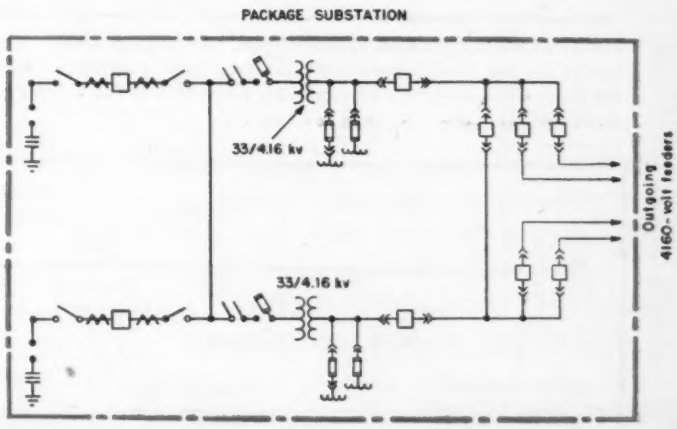
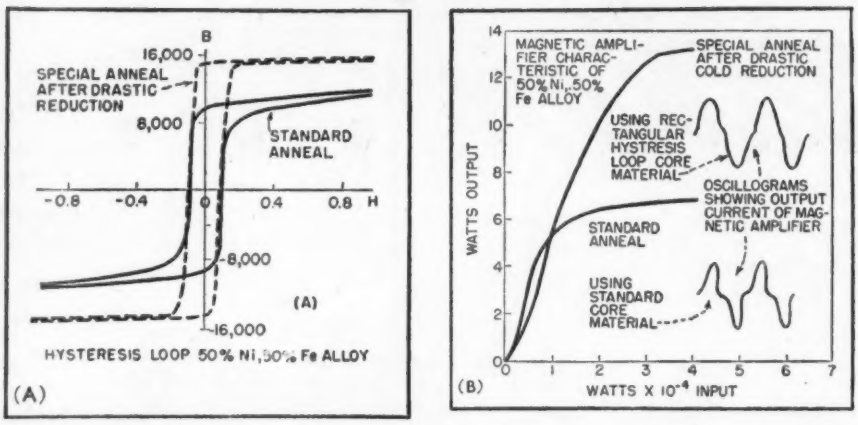
ompany, *Schenectady 5, N. Y.*



GENERAL ELECTRIC



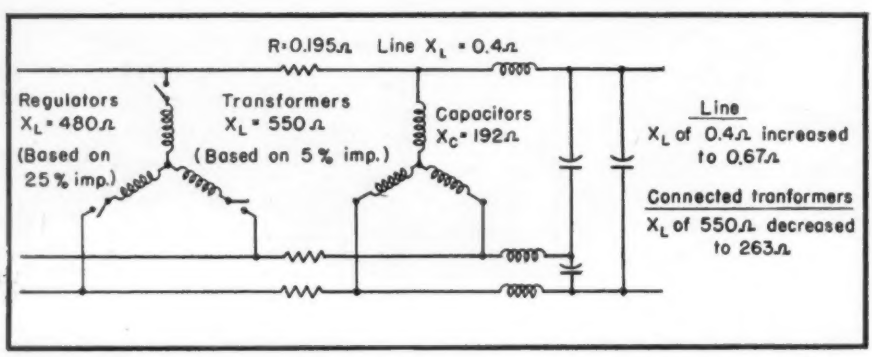
SPECIAL ANNEALING after drastic cold reduction improves amplification potentialities of Permenorm 5000-Z. (A) Magnetization curves for standard anneal and for special anneal. (B) Amplification and improved wave-form facilitated by the special anneal

rated but is saturated by full control current during the full positive half-cycle. Maximum flux density at cut-off is adjusted to give a symmetrical hysteresis loop with the sharp knee occurring at high density. For high amplification the magnetizing force at the knee should be small and this is facilitated by the practically vertical sides of the hysteresis loop.

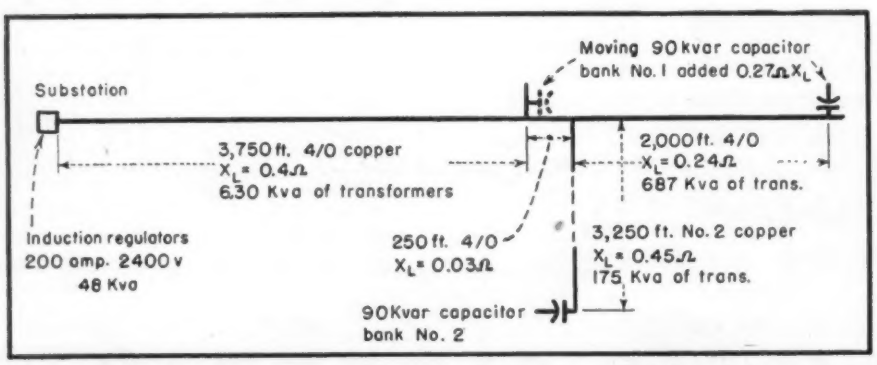
Capacitor Relocation Aids Regulator Switching

R. A. **MOULTHROP** and J. A. **JENSEN**
Pacific Gas and Electric Co
Oakland, Calif.

NEAR-RESONANT conditions due to shunt capacitor installations on distribution circuits have many times hampered switching of transformers and regulators. The general problem and one solution are illustrated by a specific case investigated and remedied by the Pacific Gas and Electric Co.



EQUIVALENT CHARACTERISTICS of the original circuit indicate a tank circuit was formed by the shunt capacitors and transformer reactance. Added transformer and line reactance after relocation of capacitors changed L-C characteristics enough to destroy near-resonance of circuit



ORIGINAL CIRCUIT conditions. Circulating current from combination of shunt capacitors and transformer reactance caused severe arcing of load side disconnect on the induction regulator. Relocation of the capacitors farther from the station added enough transformer and line reactance to remedy the condition

Study of the circuit shown showed that installation of 180 kvar of shunt capacitors would increase power factor from 89 to 95 percent. This meant an increase of 80 kva of circuit capacity at peak load on the 4-kv, 200-amp feeder. Two banks of 90 kvar each were installed—one on the main 4/0 feeder 3,750 ft from the station, the second on a No. 2 lateral tap 3,500 ft from the first.

A short time later the maintenance man found it impossible to disconnect the induction regulator for routine maintenance. The disconnect switch for interrupting the regulator charging current arced so badly it could not be opened. Examination of the equivalent circuit characteristics shown indicated that installation of the capacitors had established a partial resonant condition. The combination of capacitors in parallel with inductive reactance of the transformers provided the essentials of a "tank" circuit on the line. Field tests showed that with the remote bank of capacitors disconnected the condition still existed. When the adjacent bank was disconnected operation was normal and the regulator was disconnected with none of the previous difficulty.

Capacitor Bank Moved

To remedy the condition the first bank of capacitors was moved 2,250 ft farther out on the main feeder. This added 687 kva of distribution transformers to the line. The additional reactance of these transformers and the longer line changed the L-C characteristics of the circuit enough to eliminate the the original trouble completely.

Ammeter and voltmeter readings were made only on the earliest installations of capacitors on the PG and E system. In the absence of such tests an occasional critical condition will be revealed by abnormal switching conditions. Should it be undesirable to move the capacitors, oil switches or "load-break" type air switches may be a solution that would overcome the difficulty.

OIL CIRCUIT BREAKER

SEALED BUSHINGS

Completely-sealed bushings cut maintenance costs. Bushings are smaller, more compact, of simplified construction. Bushings can be readily adjusted to make alignment of breaker contacts easier.

IMPROVED DESIGN

New, simplified linkage of lightweight, antifriction construction means dependable high-speed performance. Other new features are a reduction in tank dimensions and over-all unit weight.

NEW INTERRUPTER

Cross-blast interrupters can be readily removed, disassembled, and inspected for field checking. They can then be easily reinstalled without disturbing in any way the adjustment of the breaker.

AIR MECHANISM

Type MA-14 self-contained air mechanism easily handles interrupting and reclosing duties down to low temperatures—with smaller batteries and control leads. Controls are readily accessible.

Your nearest G-E sales representative has further information on the new Type 439, 69-Kv oil circuit breaker. Write for our new Bulletin GEA-4985. Apparatus Department, General Electric Company, Schenectady 5, New York.

GENERAL ELECTRIC

869-10

DESIGN SERVICE CO.
PROJECT NO. 48E

PROJECT TIME RECORD

JOB: 6000 KW S.E. Station "X", Electrical Station

CLIENTS NO. 1208

DRAWING NO.	TITLE	MAN HOURS ESTIM	START DATE	% COMPLETED 25	50	75	100	TRACING IN	OUT	FEB. 14	21	28	MARCH 6	13	20	27	APRIL 3	10	17	24	MAY 1	8	15	22	29	JUNE 5	12	DUE DATE	REMARKS
8203	Bill of Material	100	3-1-48										34	77	77	86	104	104	109	112	120	130	140					6-1-48	
8202	List of Drawings	150	3-1-48					✓					20	20	20	20	20	30	46	58	58	58	60					9-1-48	See Note No. 1
8144	Cable & Conduit Schedule	225	1-24-48					✓		76	105	109	110	142	151	153	153	153	153	153	140	130	130					6-1-48	
8142	13.8 Kv. Main One Line Diag.	112	9-9-48						✓	84	84	84	84	84	84	84	84	84	84	84	84	84	84					15-48	Completed 1-14-48
8143	440 V. Aux. One Line Diag.	115	9-25-48						✓	100	100	100	100	100	100	100	100	100	100	100	100	100	100					1-15-48	Completed 1-15-48
8145	125 V. D.C. One Line Diag	115	4-14-48						✓										9	42	60	68	75					6-1-48	Completed 5-11-48
8146	Gen. Main Leads Arrg't	185	1-15-48						✓	136	136	152	170	178	181	194	194	194	194	194	194	194	194					4-1-48	Completed 3-29-48
8147	Station Grounding	150	2-10-48					✓			42	45	45	75	75	75	75	75	75	75	75	90	90					6-1-48	
8148	Cable Room Layout	200	1-12-48						✓	89	89	129	159	179	185	195	195	195	185	185	185	185	185					6-1-48	Completed 3-24-48
8150	Station Lighting Sheet #1	150	2-19-48						✓		16	50	68	68	68	84	84	84	100	120	133	147	147					5-1-48	Completed 5-12-48
8151	Station Lighting Sheet #2	150	2-14-48						✓		9	21	27	27	27	36	45	61	61	90	98	108	118					5-1-48	Completed 5-12-48
8152	Station Lighting Sheet #3	150	2-24-48					✓				16	61	61	72	72	88	97	105	105	115	131	151					5-1-48	Completed 5-12-48
8157	Conduit Turb. & Boiler Rm. Base	190	1-9-48					✓		40	72	72	80	123	123	127	127	136	150	158	158	160	160					6-1-48	
8158	Cond. Turb. & Boiler Rm. Main Fl.	185	2-4-48						✓	22	36	52	88	97	115	116	116	116	116	120	120	130	146					6-1-48	
8161	Cable Terminal Vault	150	12-6-48					✓		35	51	55	55	117	138	142	142	142	148	145	145	148	148					4-1-48	Completed 4-15-48
8162	Conduit Sections & Details	150	3-2-48					✓					20	36	47	75	115	129	130	138	138	138	138					6-1-48	
8163	Gauge Board Wiring Diag's.	110	3-18-48					✓							20	40	44	50	56	56	56	56	56					6-1-48	See Note No. 2
8164	Misc. Aux. Wiring Diag's	700	3-25-48					✓								9	11	30	35	35	35	35	35					6-1-48	
8165	Yard Lighting & Grounding	150	3-24-48					✓					9	15	25	40	60	68	75	90	105	125	138					6-1-48	
	Supervision	300								50	50	70	80	90	98	110	110	110	118	118	118	118	118						
	Miscellaneous	150								10	20	10	14	15	25	30	30	30	45	58	62	62	70						
	TOTAL	3367								674	856	1025	1196	1514	1629	1818	1851	2005	2172	2310	2419	2503	2700						

NOTES

#1. Only Preliminary study can be made, completion delayed by lack of Mfgr's. Dwgs

#2. Information from Mfgr's not available - handicaps progress.

#3. Extra work required by change in design.

PROJECT CONTROL CHART provides a record of manhours required and degrees of completion of drawing

Control Chart Aids Project Development

WALTER J. PRISE
Design Service Co
New York, N. Y.

A FUNDAMENTAL of good design practice is delivering the job in estimated time. To do this, it is necessary to have continuous control of the project development. Control charts can help in this respect by indicating the time spent on the project in relation to total time allocated. They can be used to record progress made on individual drawings and on the entire project.

A sample of such a project control chart is shown. Drawings are listed in numerical order, and estimated manhours required are given in the next column. Percentage of completion of drawing is recorded as shown. One line is used for design; another for checking. Next group of columns represents time accumulated on drawings each week. The due date at end of the chart serves as a constant reminder of time when drawings must be completed.

Each week after the project has been started, the time spent on the project during that week is entered vertically in the upper left-hand corner of the proper box. The weekly totals to date are entered horizontally in the boxes. Columns "IN" and "OUT" are used when tracings belong to a client and must be returned to him for inspection and after the job is done.

Important changes or alterations taking place during development of the design can be noted under remarks column. Complex changes can be explained in a note at bottom of the chart. In case of anticipated delays, as indicated by excessive accumulation of time on some parts of project and slow development in percentage of completion, corrective measures can be taken or request for more time can be made.

Since this record contains all important project information additional records can be made directly from it. The record of time spent on a project will at a later date be useful for estimates of similar projects.

Plastic Top Improves Control Desk

A clear plastic sheet for the top surface of a conventional all-steel control desk is used for centralized control of a recently completed petroleum products pipe line.

As explained by M. A. Hyde, Westinghouse engineer, at the AIEE summer general meeting, the plastic surface is more durable. Also, since the simplified piping diagram is applied underneath, the clear areas at appropriate points act as light indicator lenses. False operations are minimized by flush-trimmed pushbuttons. As a result, the control console has no devices projecting from the top surface.

HERE IS A TABULATION OF THE NEW RM RATINGS:

SINGLE PHASE 60 CYCLE		SELF-COOLED KVA RATINGS									
		667	833	1000	1250	1667	2000	2500*	3333	4000	5000
		SELF-COOLED/FORCED-AIR-COOLED KVA RATINGS									
High-voltage Ratings	Low-voltage Ratings	667/ 767	833/ 958	1000/ 1150	1250/ 1437	1667/ 1917	2000/ 2300	2500/ 2875	3333/ 4167	4000/ 5000	5000/ 6250
2400/4160Y	480, 600										
4800/8320Y	480, 600 2400/4160Y 2520/4360Y										
6900/11950Y 7200/12470Y 7620/13200Y 12000△ 13200△ 14400△	480, 600 2400/4160Y 2520/4360Y 4800/8320Y 5040/8720Y 6900/11950Y										
22900△ 26400△ 34400△ 43800△ 67000△	2400/4160Y 2620/4360Y 4800/8320Y 5040/8720Y 6900/11950Y 7200/12470Y 7560/13090Y 7620/13200Y 7980/13800Y 12600, 13800 13200, 14400										

NEW RM LISTINGS

Because RM transformers cover the more popular ratings, and are available with the most popular types of terminals and accessories, they can be built to standard designs. Less engineering and drafting are required, and the resulting economies are passed on to you. And—because we expect the new RM listings to be even more popular than in the past, the economies gained from larger quantity production are being passed on to you by even more favorable prices as compared with "specials."

Faster Delivery

Besides the reduction in prices, RM transformers can be delivered anywhere from six to ten months faster than specials. This is made possible by the saving in time for engineering, drafting and manufacturing.

THREE PHASE 60 CYCLE		SELF-COOLED KVA RATINGS									
		750	1000	1500	2000	2500	3000	3750	5000	7500	10000
		SELF-COOLED/FORCED-AIR-COOLED KVA RATINGS									
High-voltage Ratings	Low-voltage† Ratings	750/ 862	1000/ 1150	1500/ 1725	2000/ 2300	2500/ 2875	3000/ 3450	3750/ 4687	5000/ 6250	6000/ 7500	7500/ 9375	10000/ 12500
2400△	208Y/120, 240 480, 600 480Y/277											
4160Y 4800△	240 480, 600											
4160△ 4800△	208Y/120 480Y/277											
6900△ 7200△	208Y/120, 240 480, 600 480Y/277 2400, 2520 4160Y, 4360Y 4800, 5040											
8320Y	240 480, 600 2400, 2520 4800, 5040											
12000△ 13200△ 14400△	208Y/120, 240 480, 600 480Y/277 2400, 2520 4160Y, 4360Y 4800, 5040 6900, 7200, 7560 8320Y, 8720Y											
12470Y 13200Y	240 480, 600 2400, 2520 4800, 5040 6900, 7200, 7560											
22900△ 26400△ 34400△	2400, 2520 4160Y, 4360Y 4800, 5040 6900, 7200, 7560 8320Y, 8720Y 11950Y, 12000 12470Y, 12600 13090Y, 13200 13200Y, 13800Y 14400											
43800△ 67000△	2400, 2520 4160Y, 4360Y 4800, 5040 6900, 7200, 7560 8320Y, 8720Y 11950Y, 12000 12470Y, 12600 13090Y, 13200 13200Y, 13800Y 14400											

NEW RM LISTINGS

COMPLETE INFORMATION on the latest listings of RM transformers is in the hands of your G-E representative. *Apparatus Dept., General Electric Company, Schenectady 5, N. Y.*

GENERAL ELECTRIC

401-1

Wood Pole Constants

Data pertain to physical properties of Western Cedar, Southern Pine and Douglas Fir poles; an adaptation from Standard Specifications for Overhead Line Construction by Detroit Edison Co

Western Cedar Poles

Length, ft	Class	Min. Top Cir., in.	Min. Cir., in., 6 ft from Butt	Depth of Setting, ft	Dist. from Butt to Marking Nail, ft	Deflect. Constant,* lb-ft	Ultimate Strength,* lb	Resisting Moment,† ft-lb	Wind Load† on Pole, ft-lb	Equiv. Wind Load,* ft-lb	Average Weight, lb
20	6	17	23.5	5	12.0	....	1500	20,000	250	19	330
25	1	27	38.0	6	13.0	2980	4500	81,000	650	36	850
(Stub)	2	25	35.5			2360	3700	66,000	600	38	720
	3	23	33.0			1860	3000	54,000	550	30	600
	4	21	30.5			1440	2400	43,000	500	28	480
30	1	27	41.0	6	13.0	2040	4500	99,000	1050	48	1000
	2	25	38.5			1520	3700	81,000	1000	45	850
	3	23	35.5			1200	3000	66,000	950	43	730
	4	21	33.0			1020	2400	53,000	900	41	610
	5	19	30.5			760	1900	42,000	700	32	500
	6	17	28.5			600	1500	34,000	635	29	420
35	1	27	43.5	6	13.0	1440	4500	122,000	1450	54	1200
	2	25	41.0			1160	3700	100,000	1380	50	1000
	3	23	38.0			980	3000	81,000	1300	48	850
	4	21	35.5			770	2400	65,000	1230	45	750
	5	19	32.5			560	1900	51,000	1140	42	650
	6	17	30.5			430	1500	41,000	1080	40	560
	7	15	28.0			310	1200	32,000	980	36	470
40	1	27	46.0	6	13.0	1030	4500	144,000	2075	65	1500
	2	25	43.5			840	3700	118,000	1995	62	1300
	3	23	40.5			710	3000	96,000	1915	60	1100
	4	21	37.5			580	2400	77,000	1810	57	900
	5	19	34.5			410	1900	61,000	1646	52	800
	6	17	32.0			320	1500	49,000	1350	42	700
45	1	27	48.5	6.5	13.5	780	4500	164,000	2720	75	1800
	2	25	45.5			670	3700	125,000	2610	72	1550
	3	23	42.5			540	3000	110,000	2480	68	1300
	4	21	39.5			440	2400	88,000	2370	65	1150
	5	19	36.5			340	1900	69,000	2190	60	1000
	6	17	33.5			260	1500	56,000	1980	54	850
50	1	27	50.5	7	14.0	600	4500	185,000	3450	84	2000
	2	25	47.5			500	3700	152,000	3340	82	1800
	3	23	44.5			420	3000	123,000	3220	79	1550
	4	21	41.0			320	2400	98,000	2975	73	1400
	5	19	38.0			240	1900	78,000	2700	67	1300
55	1	27	52.5	7.5	14.5	530	4500	205,000	4250	93	2300
	2	25	49.5			470	3700	168,000	4090	90	2000
	3	23	46.0			360	3000	137,000	3910	86	1750
	4	21	42.5			280	2400	109,000	3650	80	1600
60	1	27	54.5	8.0	15.0	460	4500	225,000	5240	105	2600
	2	25	51.0			370	3700	185,000	4925	99	2200
65	1	27	56.0	8.5	15.5	370	4500	245,000	6270	114	3200
	2	25	52.5			310	3700	202,000	6015	110	2500
70	1	27	57.5	9.0	16.0	350	4500	266,000	7405	126	3600
	2	25	54.0			260	3700	218,000	7040	119	3000

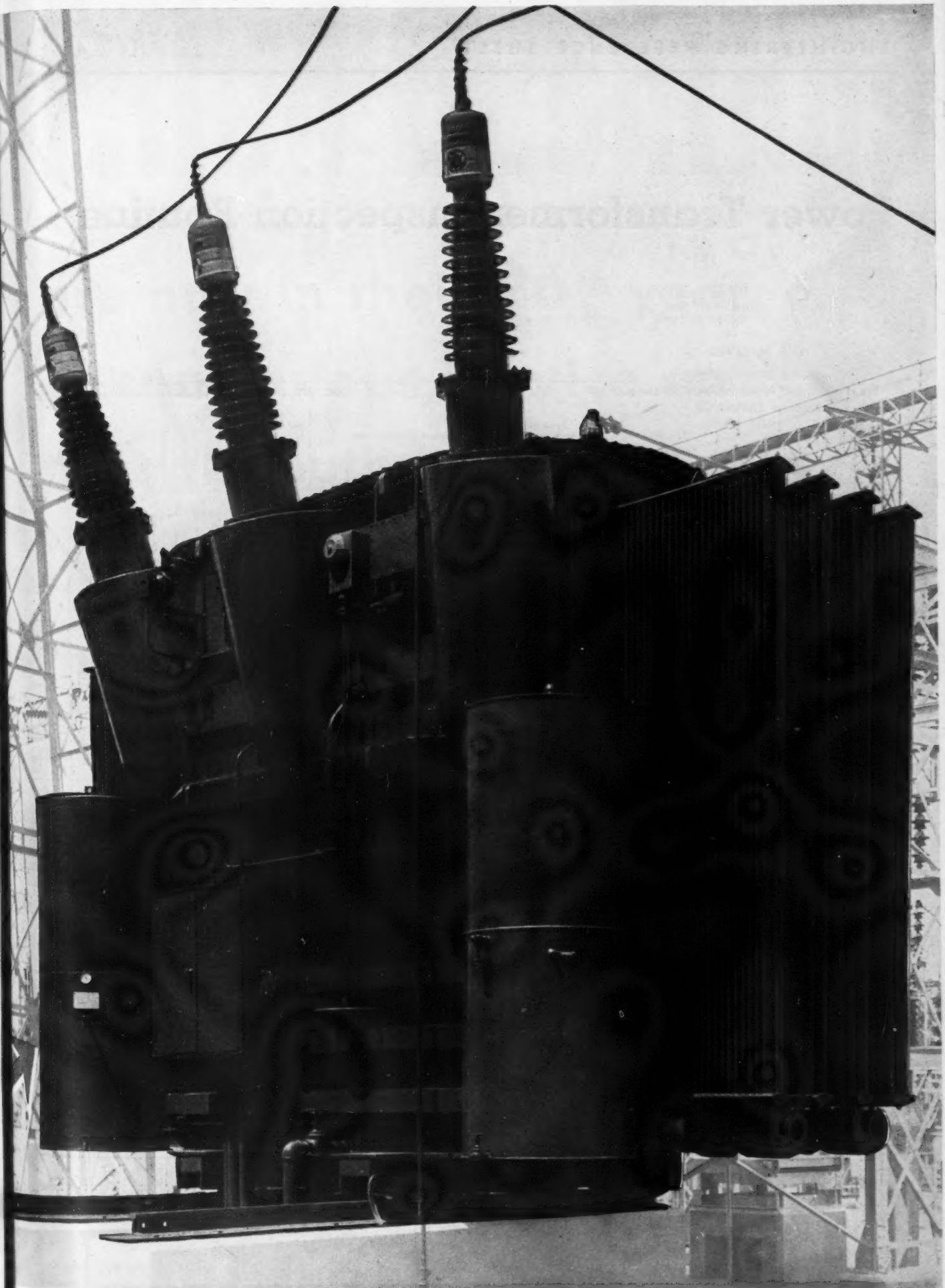
Southern Pine and Douglas Fir Poles

Length, ft	Class	Min. Top Cir., in.	Min. Cir., in., 6 ft from Butt	Depth of Setting, ft	Dist. from Butt to Marking Nail, ft	Deflect. Constant,* lb-ft	Ultimate Strength,* lb	Resisting Moment,† ft-lb	Wind Load† on Pole, ft-lb	Equiv. Wind Load,* ft-lb	Average Weight, lb
25	1	27	34.5	6	13.0	....	4500	81,000	625	37	900
(Stub)	2	25	32.5				3700	66,000	575	29	790
	3	23	30.0				3000	54,000	575	31	690
	4	21	28.0				2400	43,000	475	28	580
	5	19	26.0				1900	34,000	425	25	500
	6	17	24.0			800	1500	27,000	375	22	410
30	4	21	30.0	6	13.0		2400	53,000	875	40	780
(Stub)	6	17	26.0			600	1500	33,000	775	35	570
	7	15	24.0			475	1200	26,000	725	33	480
35	3	23	35.0	6	13.0	1060	3000	84,000	1205	45	1140
	4	21	32.0			830	2400	65,000	1145	43	1010
	5	19	30.0			620	1900	51,000	1070	40	870
	6	17	27.5			460	1500	41,000	1974	30	710
	7	15	25.5			340	1200	32,000	900	33	590
	8	15	23.0			275	880	23,750	850	30	450
	9	15	21.0			225	660	18,000	800	29	300
40	1	27	42.0	6	13.0	1420	4500	144,000	2135	62	1860
	2	25	39.5			1090	3700	118,000	2015	63	1610
	3	23	37.0			890	3000	96,000	1840	58	1460
	4	21	34.0			650	2400	77,000	1710	53	1260
	5	19	31.5			460	1900	61,000	1545	48	1060
	6	17	29.0			340	1500	48,000	1420	44	870
	7	15	27.0			250	1200	38,000	1330	42	730
45	1	27	44.0	6.5	13.5	1080	4500	164,000	2765	76	2220
	2	25	41.5			850	3700	135,000	2635	72	1990
	3	23	38.5			670	3000	110,000	2425	67	1740
	4	21	36.0			480	2400	88,000	2200	60	1500
	5	19	33.0			350	1900	69,000	2070	57	1260
	6	17	30.5			250	1500	55,000	1900	52	1060
	7	15	28.5			190	1200	44,000	1745	48	900
50	1	27	46.0	7	14.0	890	4500	185,000	3500	85	2690
	2	25	43.0			670	3700	152,000	3290	80	2340

NOTES
(For both tables)

Deflection constant is the horizontal force (pounds) which when applied 2 ft below the top of an unguyed pole will cause the top of the pole to deflect 1 ft. The figures given are for average pole diameter for the class, not minimum.

* 2 ft below top † At ground line



Power Transformer Inspection Routine

F. I. MANVEL
Retired, formerly of the
Transformer and Allied Products Divisions
General Electric Co
Pittsfield, Mass.

A schedule of inspection for 50 items on various types of power transformers and auxiliary equipment

Type of Transformer or Apparatus	Nature of Inspection	Ref. No.	Frequency of Inspection: Hourly (a)	Daily	Weekly	Monthly	Quarterly	Semiannually	Yearly	2 Years	10 Years	15 Years	When oil tests low	See Note
All Oil-Insulated Transformers	Oil level	1	x											
	Ambient temperature	2	x											
	Oil temperature	3	x											
	Coil temperature	4	x											
	Load (amperes)	5	x											
	Voltage	6	x											
	Relays	7				x								
	Lightning arrester coordination gaps	8					x							
	Ground resistance	9					x							
Open Type Transf. (No Conservator) (No Gas Seal)	Oil tests	10					x							
	Oil filtering	11								x			x	
	Inspection under the cover	12				(b)		x						(b)
	Inspection above the core	13								x				
	Over-all inspection	14									x			
	Breathing	15					x							
Transf. with Conservator or Gas Seal	Relief diaphragm	16	x											
	Oil tests	17					x							
	Oil filtering	18											x	
	Inspection above the core	19									x			
	Over-all inspection	20										x		
Water-Cooled Transf.	In-out water temperatures	21			x									(c)
	In-out water flow	22						x						(d)
Forced-Oil Cooled Transf.	In-out oil temperatures	23			x									
	Pump glands	24	x											
	Cooler sceens	25			x									
Fan-Cooled Transf.	Fan control	26				x								
	Condition of motor and fan	27				x								
Air Blast Indoor Transf.	In-out air-blast temperatures	28	x											
	Compressed-air cleaning	29			x									
Gas Seal Equipment	Gas pressure (mercury gage)	30		x										
	Oxygen content (First month of operation	31			x									
	Oxygen content (After first month	32						x						
	Cu. ft. gas in cylinder	33		x										
	Functioning of mercury relief valve	34					x							
	Minimum pressure alarm circuit	35					x							
	Functioning of gas regulator	36					x							
Misc.	Gas-oil-seal Transf.	37				x								
	Sealed Transf.	38						x						(e)
	Pyranol Transf.	39						x						(f)
Load-Ratio-Control Apparatus	Contactors	40							x					
	Nonarcing tap selectors	41									x			
	Arcing tap selectors	42							x					
	Stuffing Boxes	43							x					
	Oil tests	44					x							
	Relief diaphragm	45	x											
	Mechanism	46							x					
	Ventilators	47							x					
	Automatic control	48				x								(g)
	Disconnect switches	49												
Spare Transformer		50												(h)

NOTES

(a) The 10 items included in this line represent those things which should be checked by the station attendant when making his regular rounds of the station, which are assumed to be made approximately hourly.

(b) Initial operation.

(c) Check efficiency of cooling system weekly. Advisable to make yearly pressure test on cooling coils over 10 years old.

(d) Initially, determine actual pressure and water flow of each section of cooling coil. Check semiannually for any deviation requiring coil cleaning.

(e) Check pressure-vacuum gage if installed, otherwise make 5-lb pressure test with dry nitrogen. Observe items listed under gas-seal transformer.

(f) Take Pyranol samples and follow item 38.

(g) When Pyranol or oil is renewed as recommended, clean all insulating surfaces and inside of compartment; inspect switch interior and contacts.

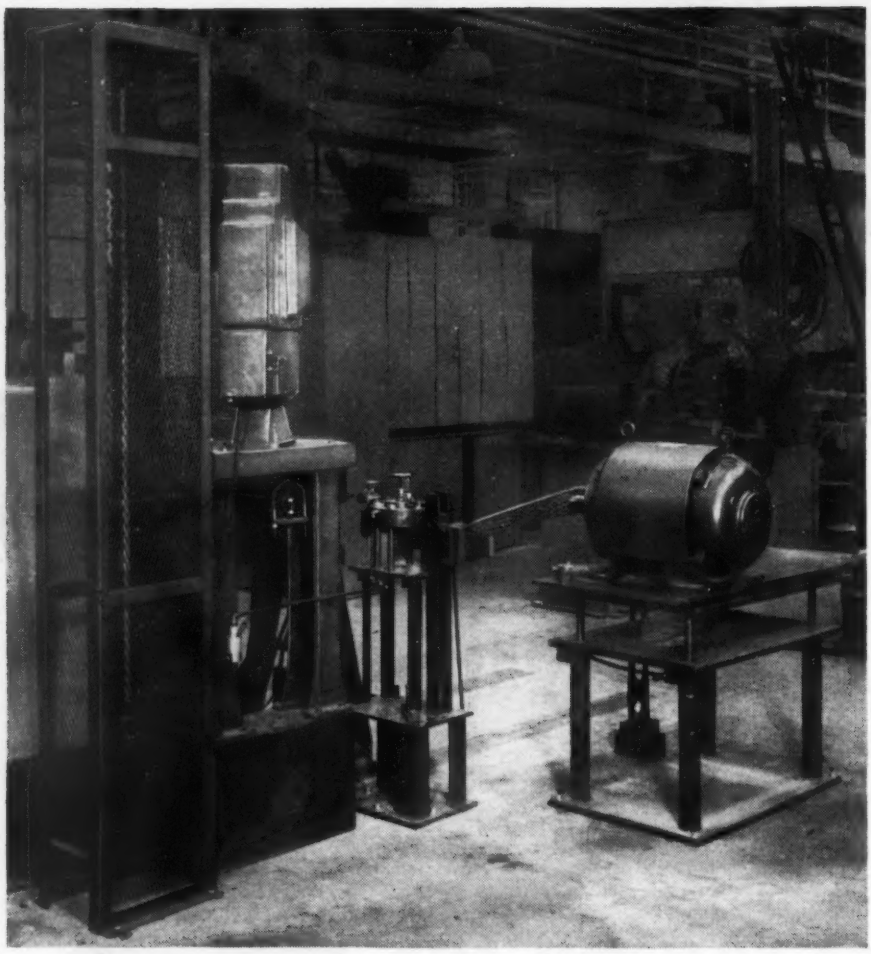
(h) During storage period, apply inspection routine covered by items 1, 10-12, 16-18, 26, 27, 31-40, 45, 46, 49.

Filled Bushings

are now in their 26th year of continuous service on a large southern system.

Performance like this is the soundest reason for making O-B your

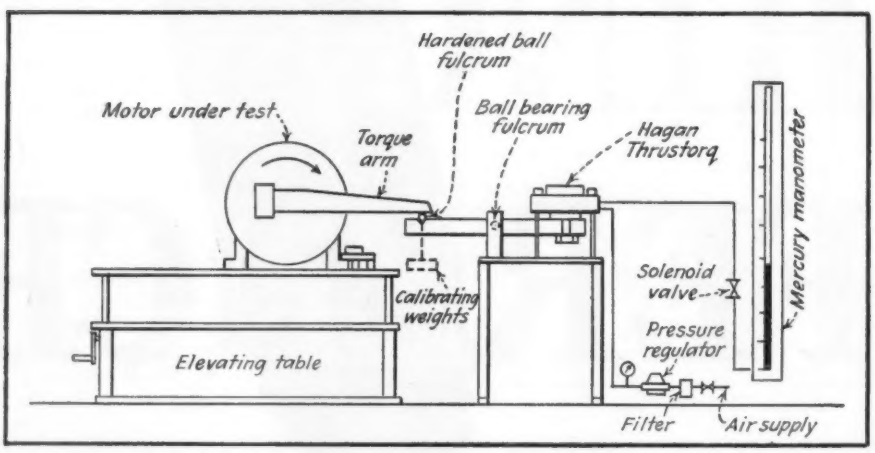
BUSHING PREFERENCE



TEST SET UP for measuring locked rotor torque. Motor on elevating table at right, pneumatic element in center, and manometer in cage at left

New Technique Speeds Locked Rotor Torque Tests

LOCKED ROTOR TESTS on a-c motors from 1 to 15 hp have been greatly simplified by a new technique worked out by engineers of the Reliance Electric & Engineering Co. The scheme substitutes a balanced-diaphragm pneumatic instrument and mercury manometer for the dynamometer and indicating spring-type scale arrangement commonly used for measuring locked rotor torque of motors.



LOCKED ROTOR TEST SCHEME substitutes balanced diaphragm pneumatic instrument and mercury manometer for spring-type scale and dynamometer in measuring locked torque. Air pressure, required to balance force exerted on one side of measuring device by torque arm and beam, is measured by manometer

Before this new technique was introduced, at the company's new Engineering, Development and Service Center in Cleveland, it took three men nearly three hours to set up and test with the usual dynamometer and scale. Now one man can couple up the motor and run the test in a tenth of the time previously required.

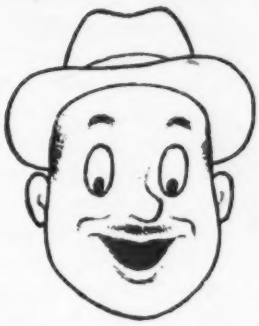
Heart of the new scheme is a "Thrustorq." This is a balanced-diaphragm type pneumatic instrument in which the applied force is counterbalanced by air pressure. Magnitude of the air pressure required to counterbalance the force exerted by the torque arm, in the Reliance scheme, is measured on a mercury manometer. The maximum range of mercury manometer readings on normal and high-slip motors is up to 15 hp.

As shown in the accompanying schematic diagram the force exerted by the torque arm is applied to a hardened spherical button on one end of a "walking beam," the other end of which acts on the Thrustorq. Three torque arms 6, 12 and 30 in. long cover the range of torque requirements encountered. These arms are counterbalanced so that no tare weight is encountered. The socket on each arm that bears on the hardened button of the beam has been lapped to insure good contact with minimum friction.

The 60 in. single column mercury manometer that measures the air pressure required to balance torque arm force can be placed at some distance from the detecting instrument. In this case it is located at the electrical metering and control stand; this centralizes all indicators at one point for the operator's convenience.

The torque measuring system is calibrated by hanging known weights on a hardened V fulcrum at the bottom position on the beam. The corresponding mercury column height is recorded and a curve drawn to get the straight line relationship between weight (force) and mercury column height. Slope of this curve is the constant for converting inches of mercury to pounds of force applied to the beam. Locked torque of a motor is the product of this constant, height of the mercury in inches and torque arm length in feet. While the manometer could be calibrated directly in

is doing to boost the area you serve



3.

NETWORK RADIO

Carries the story of G-E Sun and Heat Lamps to millions of listeners, with General Electric Lamp's sparkling quiz show "What's My Name?", starring Arlene Francis. Every Saturday night on the ABC network.

4.

LOW PRICES

G-E SUNLAMP—*NEW LOW PRICE*—
formerly $9.95 . . . *now only* . . . **$8.50**

G-E HEAT LAMP
Hardglass model with red filter . . . **$2.95**
Standard model . . . **$1.10**

G-E LAMPS

GENERAL ELECTRIC

BERMICO* FIBRE CONDUIT

BERMICO CONDUIT IS REALLY RUGGED—IT'S BUILT TO TAKE ROUGH HANDLING ON THE JOB.
ITS CLEAN, SMOOTH BORE MAKES PULLING CABLES THROUGH BERMICO FIBRE CONDUIT QUICK AND EASY.

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BERMICO FIBRE CONDUIT—A PRODUCT OF BROWN COMPANY

torque, this would reduce the equipments' flexibility.

Compared with the former spring-scale set up, this new scheme for measuring torque has several advantages. Foremost is the saving in man-hours effected in check testing motors in the laboratory. It is now possible, when required, to test three times the number of motors in a day that were formerly handled. Also, a dynamometer is released for other development testing. Maintenance of equipment is appreciably lower. The system is calibrated once a year. No repairs are anticipated as against calibration and repairing of the spring-type scale on the average of one a month. Cost of the new system, complete, was less than the price of a spring-type scale alone. Further, the indicating manometer can be placed in a remote location from the measuring element when desired, permitting easier reading. Accuracy of the system is calculated to ½ of 1%.

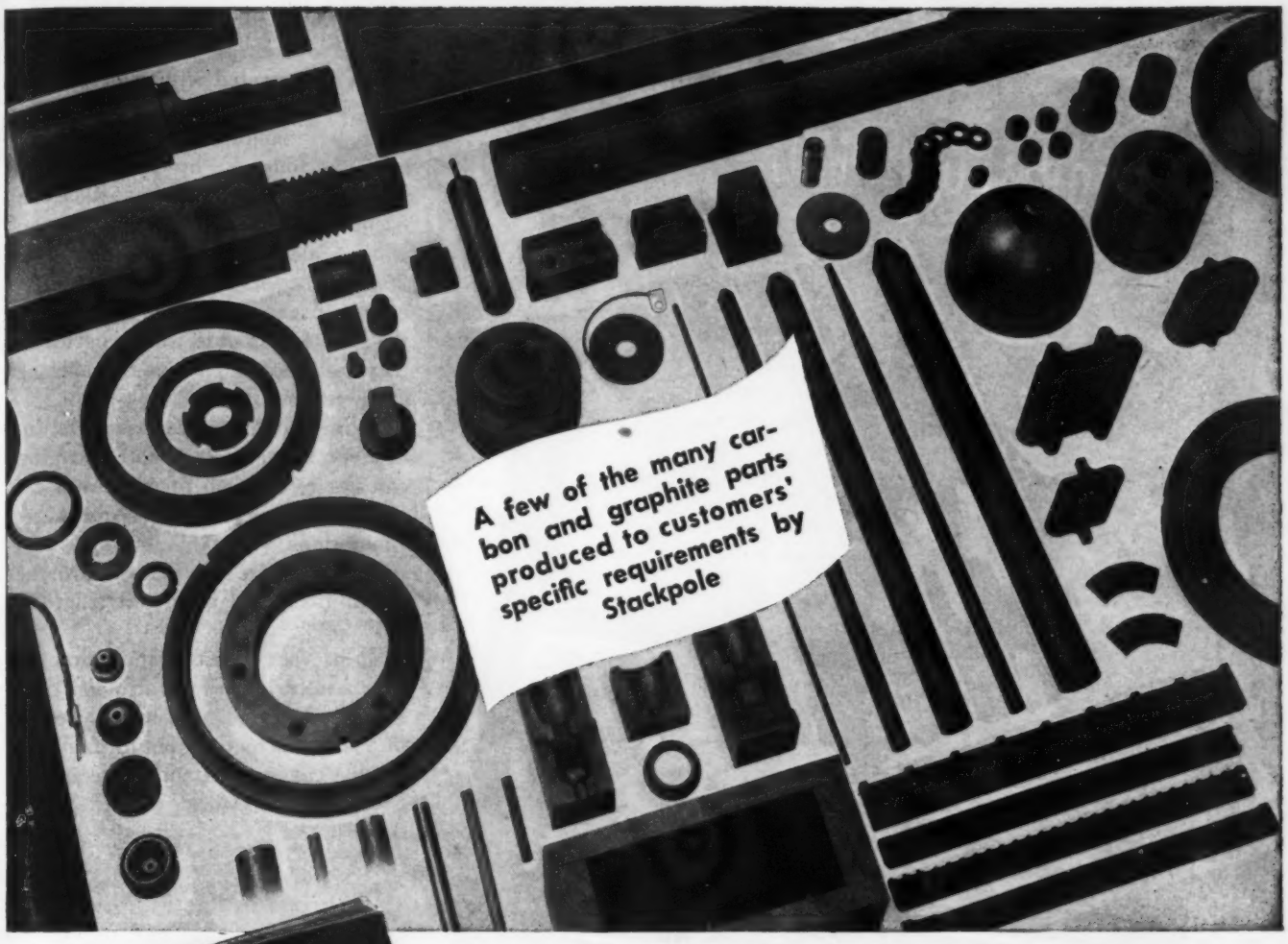
Limitations of the set-up are chiefly three: (1) compressed air supply is required for operation; (2) installation of the system is more complicated, and (3) piping is required for compressed air supply and to indicating devices.

These disadvantages are eclipsed by the advantages, according to W. C. Jenner, Reliance experimental engineer. He reports plans to install three additional units, two for production line testing and a third for use in the experimental and development laboratory. All these units will be used in conjunction with electric dynamometers.

Regenerate Ion Exchangers Carefully

CAUTION BY POWER PLANT engineers in the use of sulfuric acid for regeneration of hydrogen-cycle ion exchangers was advocated in a recent paper by Thompson and McGarvey of The Resinous Products & Chemical Co presented before the Water Conference of the Engineer's Society of Western Pennsylvania. The use of concentrated solutions of the acid causes calcium sulfate to plate out on the exchange resin and markedly reduces exchange capacity.

Even though there is no visual indication of precipitated calcium sulfate coating the resin particles, this



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Carbon and Graphite have been termed "the most flexible of Mother Nature's materials"... and for more than two decades, Stackpole has been proving the accuracy of this statement as applied to engineering problems involving friction, temperature, arcing, corrosion, shaft sealing and other related factors. Stackpole will be glad to work with you and your organization on any specific problem which carbon, graphite or powdered metal specialties might help solve.

STACKPOLE CARBON COMPANY • ST. MARYS, PA.

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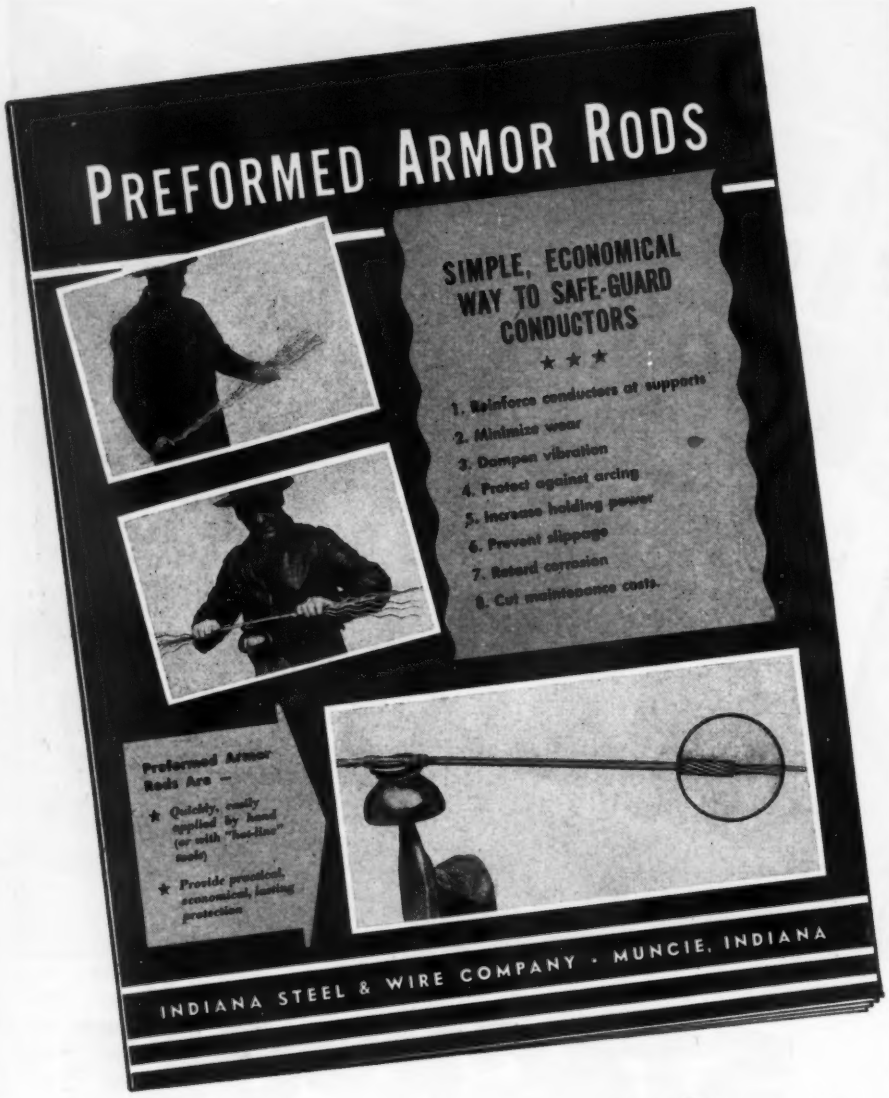
Far more than being a mere catalog, the Stackpole CARBON SPECIALTIES BOOK contains a wealth of detailed information that should prove invaluable in helping you evaluate the unique possibilities of carbon, graphite, and powdered metal materials in solving a wide range of engineering and production problems. Write for your copy today using your company letterhead. Ask for Booklet No. 40.


PREFORMED ARMOR RODS
SIMPLE, ECONOMICAL WAY TO SAFE-GUARD CONDUCTORS
★ ★ ★
1. Reinforce conductors at supports
2. Minimize wear
3. Dampen vibration
4. Protect against arcing
5. Increase holding power
6. Prevent slippage
7. Retard corrosion
8. Cut maintenance costs.
Preformed Armor Rods Are —
★ Quickly, easily applied by hand (or with "hot-line" tools)
★ Provide practical, economical, lasting protection
INDIANA STEEL & WIRE COMPANY · MUNCIE, INDIANA

Write for This Booklet!

PREFORMED ARMOR RODS provide a simple, practical, economical method of reinforcing and protecting overhead conductors at the point of and in the region of the supports. They minimize wear and chafing, tend to absorb and dissipate vibration, protect the conductor against arching and flash-overs, afford increased holding power against slippage, lessen the possibilities of corrosion, reduce overall maintenance expense.

Easily applied by hand or with "hot line" tools. Available in galvanized or stainless steel, aluminum, copper or bronze.

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Please ask for Booklet PR-101

INDIANA STEEL & WIRE COMPANY · MUNCIE, INDIANA

condition is forcefully indicated by the large contrast in capacities of resins regenerated with concentrated sulfuric acid and those regenerated with hydrochloric acid or sodium chloride followed by sulfuric acid. This clogging of the resin surface can occur after treating raw water in which calcium ions constitute over 25% of the total cation content. The condition can become so severe that the sulfate content of water is actually increased during passage through the exhange unit.

Beds which have been rendered inefficient by calcium sulfate clogging can be brought up to maximum exchange capacity by subsequent regenerations with 0.5% sulfuric acid solutions. These solutions dissolve the contaminant and remove it from the bed.

To prevent such contamination the use of sulfuric acid not stronger than 1% is advocated. A further precaution is a sufficiently rapid through-put for the calcium sulfate to precipitate only after it has been carried out of the bed.

Salvaging Used Power Cables—V*

W. H. MEADE
Technical Standards and Test Section
Boston Edison Co.

THE ECONOMIC VALUE of used cable salvage is something of a problem. A wide divergence of opinion exists as to the comparative values of salvaged *vs.* new cable. Opinions have been advanced ranging anywhere between 70 to 100% of new cable value. Those leaning toward the lower percentage figure that it would be im-

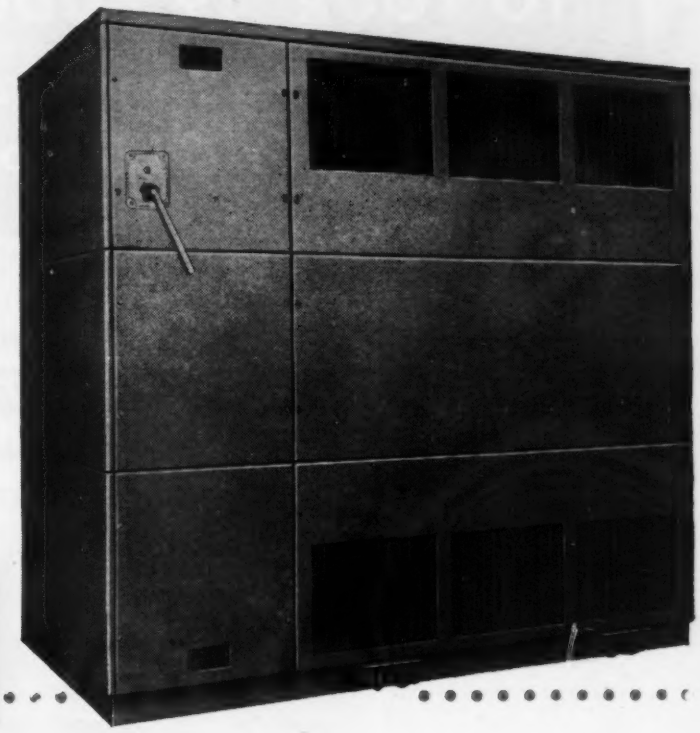
INSPECTING lead sheath for defects

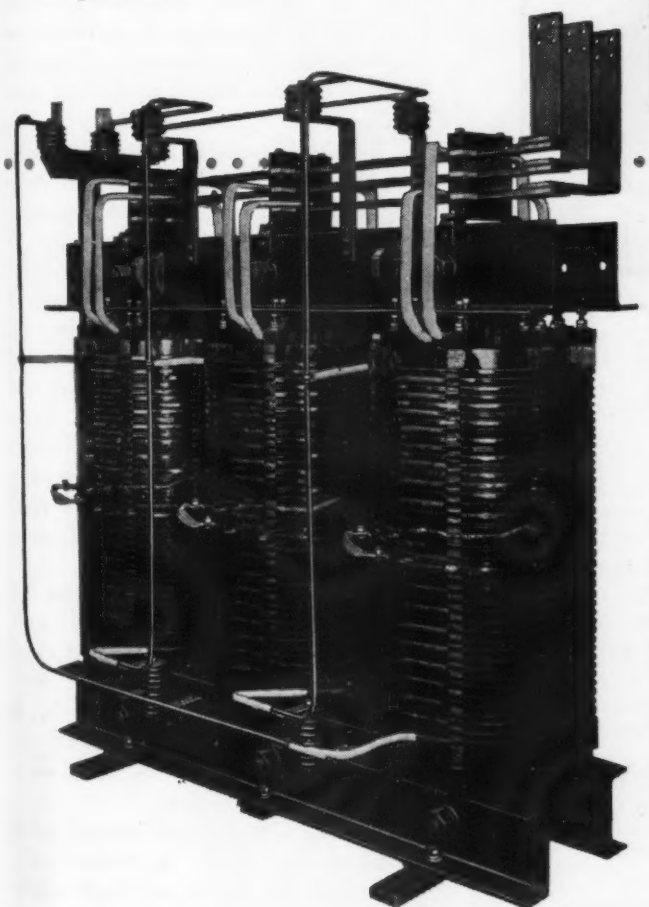
* Concludes the series which began in EW, July 31, 1948, p 116.

Wagner Dry-Type Indoor Transformers

Now available in ratings from 100 to 2000 kva

To meet industry's growing need for larger indoor dry-type load center transformers, Wagner has broadened its line of three-phase dry-type transformers to include ratings up to 2000-kva in the 15-kv class and below. Especially developed for plant power distribution circuits, these units are compactly housed in neat, attractive enclosures, which can be arranged to include primary and secondary switchgear compartments to form readily accessible, closely-coupled unit substations. Complete enclosure of all equipment protects against accidental contact with live parts. Relatively light in weight, so that they can be used in multi-story buildings, they are readily adaptable to any installation requirement.





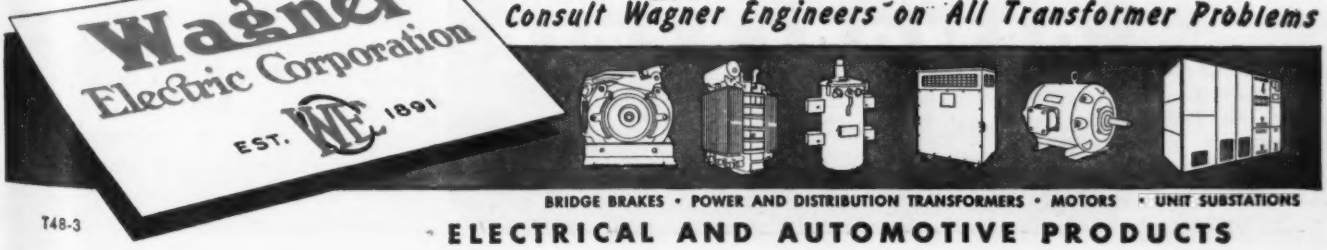
More than fifty years of transformer building experience has been incorporated in the design and construction of these transformers. The coil conductors are insulated with double servings of fiber glass. The windings are insulated from each other and from the core and mechanical parts using Class B and Class C materials, the latter being employed where extra strength is required. The core is sturdily constructed, and both the core and the coil stacks are provided with vertical ducts for effective cooling. The entire core and coil assembly is given successive baked coats of heat resistant synthetic varnish which produces a tough, high gloss finish. The connections between phases and to the switch gear are securely braced and well insulated from each other and from ground, and the conducting surfaces of all clamped joints are silver plated to prevent corrosion.

Transformers can be furnished with equipment for indicating winding temperature. Fans for increasing the capacity 25% may also be provided when the possibility of load growth warrants this addition.

Bulletin TU-56 describes in detail the transformers, the enclosures, the various types of incoming line sections available, and the optional equipment and accessories that can be furnished. Write for your copy today.

Wagner Electric Corporation
6456 PLYMOUTH AVE., ST. LOUIS 14, MO., U. S. A.

Consult Wagner Engineers on All Transformer Problems



BRIDGE BRAKES • POWER AND DISTRIBUTION TRANSFORMERS • MOTORS • UNIT SUBSTATIONS

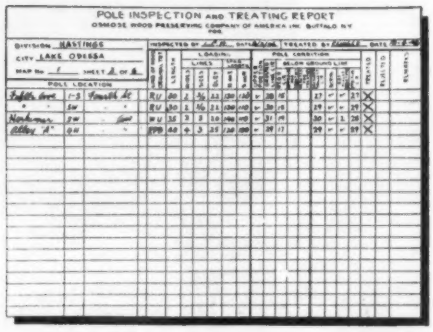
T48-3

ELECTRICAL AND AUTOMOTIVE PRODUCTS

ADD OSMOPLASTIC TO YOUR '49 BUDGET ...and you add years of LIFE to your OLD poles

OSMOPLASTIC GROUND LINE *treatment*

1 LOWERS POLE MAINTENANCE COST



POLE INSPECTION and TREATING REPORT

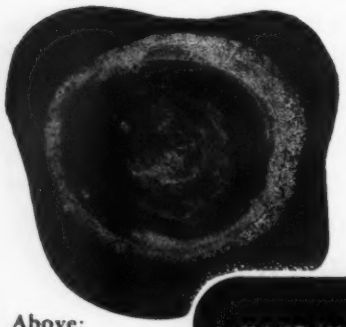
OSMOSE WOOD PRESERVING COMPANY OF AMERICA INC. BUFFALO N.Y.

2 GIVES YOU THIS ACCURATE POLE RECORD

Groundline decay* of standing poles eats a big hole in every Operating Budget! Plan NOW to drastically reduce FUTURE pole replacement costs with Osmoplastic Groundline Treatment which not only protects the surface but penetrates deep into the wood destroying all fungi and preventing further decay. While treatment is being applied, the above card is filled in which gives you a complete Pole Record and Inventory to facilitate future planning.

Many prominent utility companies have cut their operating costs and increased their efficiency with this simple, inexpensive but highly effective Osmoplastic treatment. Let us submit estimates and explain how our experienced field crews can handle this work for you at surprisingly low cost. Or, if your prefer, we will supply the materials for your own application. Write today for complete details!

*From six inches above to twelve inches below ground.



Above:

White areas of this pole cross section show the deep penetrating action of the toxic chemicals in Osmoplastic.

MAKE INSPECTION TIME, PROTECTION TIME WITH

OSMOPLASTIC

Patented and Patents Pending

OSMOSE WOOD PRESERVING COMPANY OF AMERICA, INC.

GENERAL OFFICES: BUFFALO 12, N. Y.

BRANCH AND SALES OFFICES: BIRMINGHAM 3, ALA.; DENVER 2, COLO.

REPAIRING SHEATH of used paper and lead cable by lead burning

possible to subject the cable to abuse inherent in at least one installation and removal after use without reducing the remaining useful life.

Those inclining toward full value hold that the cable has withstood the most significant test of all—service. This is viewed in conjunction with the fact that inspection and test requirements are sufficient to insure a useful life equivalent to that of new cable.

To obtain a rough idea of the value of this work, assume that the 70% figure is correct. The test specimen selected will be a 300-ft length of 3 x 350,000-cm, 15-kv, paper-insulated, lead-covered cable. This is a common size and voltage rating on the Boston Edison system, and of about average length. Cost of this cable new, is now about $750. Present junk value is about $309. Taking the 70% life, value to the company becomes $525. Salvage costs total about $40. Thus a net gain of about $176 is indicated.

In the overall salvage picture the above figure would be reduced somewhat because of the material derated to lower voltage or junked after varying sums have been spent on it. It would be still further cut by increased installation costs based on a 70% useful life figure.

In general it appears that salvaging used power cables is economically sound. In the past decade Boston Edison has put about 370,000 ft of paper and lead cable through its salvage procedure. Of this, 250,000 ft was approved for re-use at original voltage rating; 83,000 ft was derated, and 37,000 ft junked. Cable salvage greatly aided the company's stock control during the war years and has since been valuable under prevailing market conditions.

New CHANCE 8-way Expanding Anchor

Here is another answer to the problem of rapidly rising line construction costs! The new Chance 8-way Expanding Anchor gives you more holding power for less money.

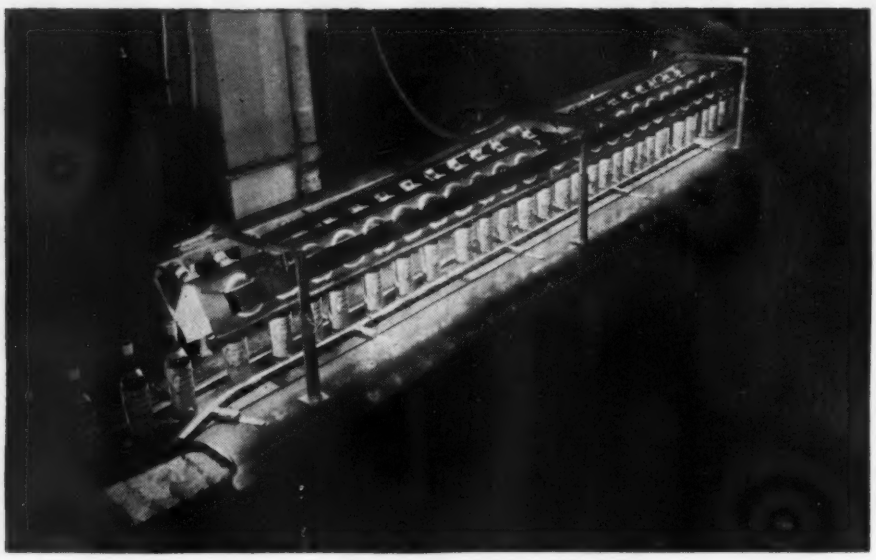
Better load distribution makes this new Chance Anchor stronger than other expanding anchors — and the absolute simplicity of its construction makes it the most smoothly operating expanding anchor on the market.

C4816

CENTRALIA, MO., SAN FRANCISCO, CAL.

ABC INDUSTRIES

LOAD BUILDING



INFRA RED HEATING seals plastic bottle tops 360 times faster. Two rows of twenty three 375 watt lamps straddle the conveyor

Infra Red Seals Plastic Caps in 29 Seconds

INFRA-RED heating has reduced to 29 sec the three hours formerly required to seal wine bottle tops with plastic covers in the plant of Shewan and Jones, Inc, Lodi, Calif. The covers are slipped over the bottles and dried in place by infra-red lamps. As they dry, they shrink and seal either corks or screw caps on the bottles.

Heat is supplied by two staggered rows of 23 375-watt infra-red lamps. Four adjustable channels with copper baffles and guides support the lamps on 6-in centers. The two rows of lamps are focused directly on the necks of the moving bottles. The bottles travel on a conveyor belt the length of the 12-ft rack in 29 sec. When the bottle has passed through the sealer it is ready to be boxed and carried away. The sealer, developed by Wuelker Infra Red and Lighting Co. of San Francisco (pat. pend.), is adjustable for any size container.

Electric Heaters Modernize Calender

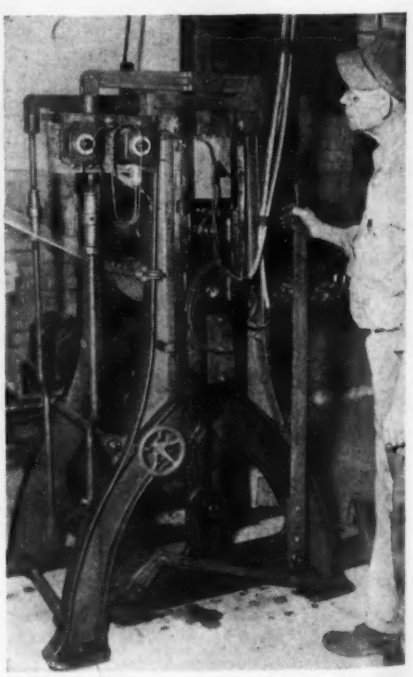
INSTALLATION of two roll-type heating elements, two adjusting thermostats and two rheostats converted a non-automatic flame-heated calender pressing machine to adjustable automatic electric operation. The local adaptation was devised by the mill mechanic of the Classe Ribbon Works, Anniston, Ala., and Harry Hohlmann, Division Service Supervisor of Alabama Power Co.

The electrical heating device on the calender was made up of eight ½-in. diameter, 21-in. long, 400-w, 115-v alloy sheath units. Two units were connected in series to operate on 230 v. This gave 3200 w per roll and a density of 14 w per sq in. The eight round units were mounted on three separation plates for a circular assembly and place stationary inside the rotating roll, replacing the flame heat. An eight-unit assembly was used in each of the two metal rolls, one above the other.

Temperature is controlled by a calibrated, non-indicating thermostat for each assembly. Latter has a steel bulb and 5 ft of capillary tubing with a temperature range of 100 to 1000 F. In addition to the thermostat, a 230-v, 3500-w rheostat is used with each roll assembly.

Cost of all the equipment for one lender (two roll assemblies) delivered to the customer, including Alabama sales tax, was $408. The installation was not expensive and was made by the Classe Ribbon Works electrician.

Advantage of electric heating on the calender is the controlled temperature obtained for various types of satin. It was reported that the quality of the product is considerably improved. While the actual electric operating cost in this particular installation is probably more than with the flame type heat, the advantages are said to outweigh the increased cost of operation.



CALENDER pressing machine has rolls converted to adjustable automatic electric heat operation

IT'S ALL-ALUMINUM

THE BUS:

8" dia. Alcoa Aluminum Tubular Bus

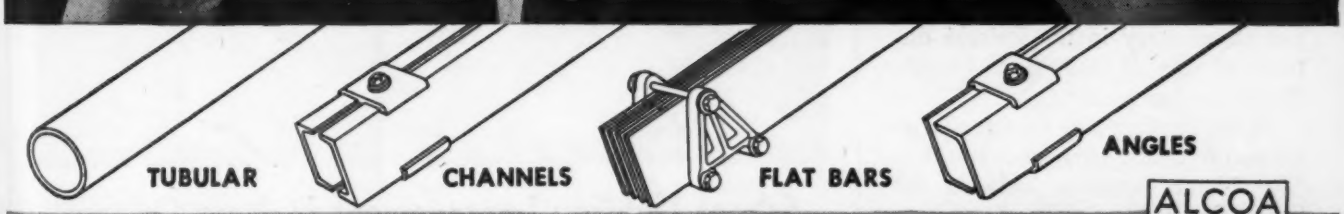
THE WELD:

Inert-arc... No Flux

There's only one thickness of metal at the welded joints in this 8-inch tubular bus conductor of Alcoa Aluminum. Freedom from overlaps and bolted fittings gives additional space saving.

You get maximum current-carrying efficiency through welded *all-aluminum* joints. There's no danger of high resistance between connecting surfaces, no flux to cause blowholes, slag pockets, or corrosion in the joint.

Ask us for information and engineering data to help you design with Alcoa Aluminum Bus Conductors. And we'll tell you how to weld aluminum, too. ALUMINUM COMPANY OF AMERICA, 2138 Gulf Building, Pittsburgh 19, Penna. Sales offices in 54 leading cities.



ALCOA ALUMINUM BUS CONDUCTORS

ALCOA ALUMINUM

IN EVERY COMMERCIAL FORM

BARN-HAY CURING

A Sure Way To Better Hay

Advantages:

- GREENER LEAFIER HAY
- MORE FOOD VALUE
- NO LOSS OF HAY IN BAD WEATHER
- WORTH MORE PER TON

We Sell The Following Hay Drying Equipment:

- ROBINSON FANS
- ELECTRIC MOTORS
- GENERAL ELECTRIC HAY-DRIER CONTROLS
- GENERAL ELECTRIC TIME SWITCHES
- WIRING MATERIALS

Harrison-Hancock Hardware Co.

Wytheville, Virginia

DEALERS cooperated with advertisements

Concentrated Promotion Sells Hay Driers

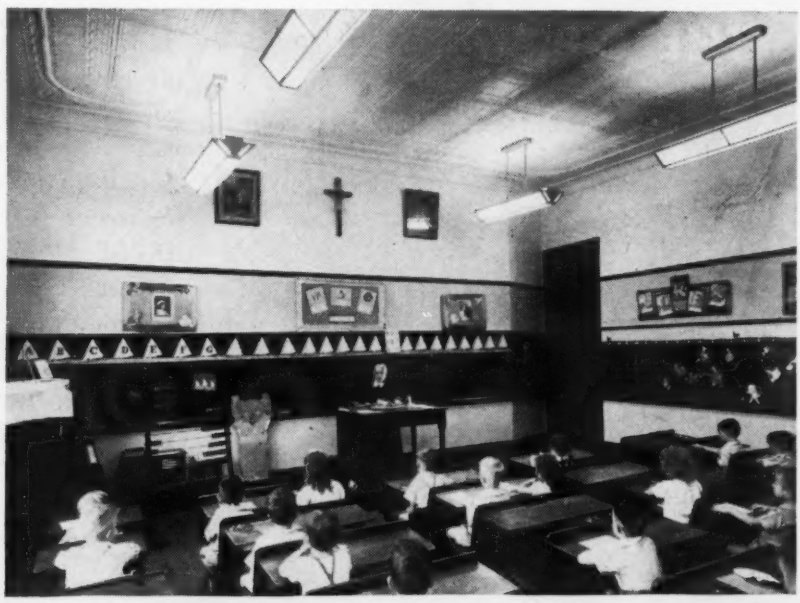
R. J. BLAIR
Appalachian Electric Power Co
Pulaski, Va.

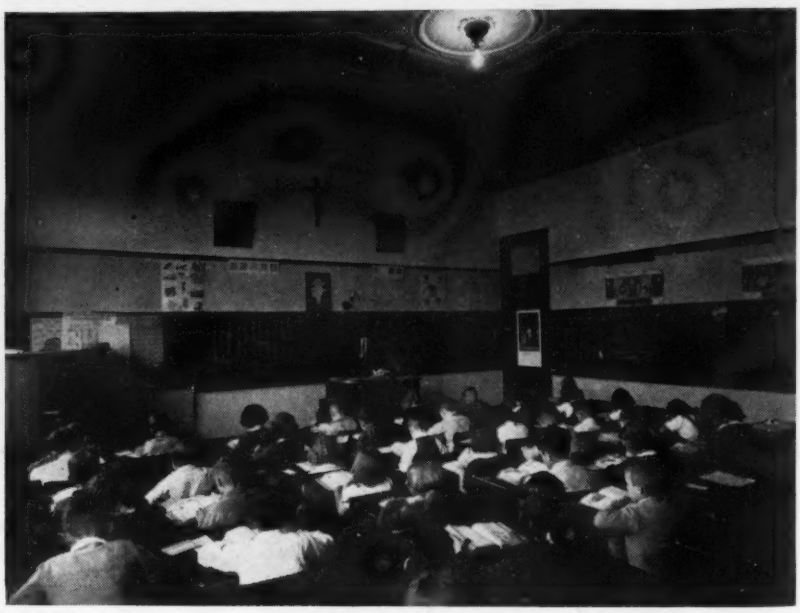
THIRTY MEETINGS with attendance totalling 1,356, local newspaper stories, dealer advertisements, letters to farmers, radio talks and farm inspection tours, were all used to tell the hay dryer story in the Pulaski district of the Appalachian Electric Power Co last winter.

Of the meetings, 19 were for farmers and veterans. Attendance was 871. The 2-hour program included the film, "Green Hay," talks by county agents, showing of samples of mow-cured hay and of a hay dryer model, and discussions as the program moved along. The other 11 meetings were school periods of vocational agricultural classes. These shorter programs brought the story to 485 FFA boys.

Newspaper stories prepared by county agents with the help of AEP men appeared in 10 weekly and 2 daily papers. Follow up stories after the meetings appeared in local newspapers. Local dealers chimed in with advertisements like the one illustrated and set up displays of hay drying equipment in their show windows. Company-sponsored radio programs also emphasized the benefits.

Letters urging that orders for equipment be placed early, were sent to about 200 farmer prospects. Much of the effectiveness of the whole activity resulted from the cooperation of county agents. One of them, J. M. Hepler, made arrangements for his Montgomery County farmers to visit Virginia Polytechnic Institute in a group inspection of the 4 types of hay driers there.

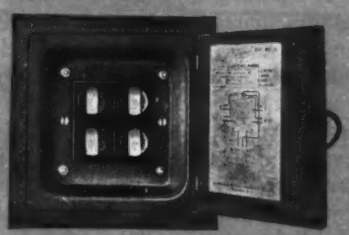




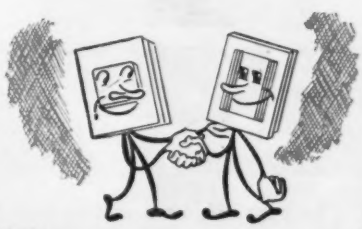
School Lighting Improvement in New Orleans

THAT ONE BARE LAMP in the center of the ceiling, all the poor lighting it represents, did much to impair the vision of successive generations of school children. Its harmful reign was ended at St. Henry school when engineers of New Orleans Public Service Inc, designed planned lighting installations for the school's 8 classrooms. Each room now is lighted by six direct-indirect fluorescent fixtures each containing 4 40w lamps. Average light intensity is now 34 ftc, as against gloom before. Electricity requirement was raised from 0.23 to 1.85 w per sq ft

FUSES VERSUS MULTI-BREAKERS



WHETHER you favor the fuse or the multi-breaker . . . you're entitled to the maximum in circuit protection. On both fuse devices and multi-breakers, the Federal NOARK label stands for the highest engineering standards, thoroughgoing honesty of manufacture, and complete reliability. For either type of protection, it pays to specify Federal NOARK. Write for the latest issue of the "Federalog".



Federal NOARK *Service Equipment*

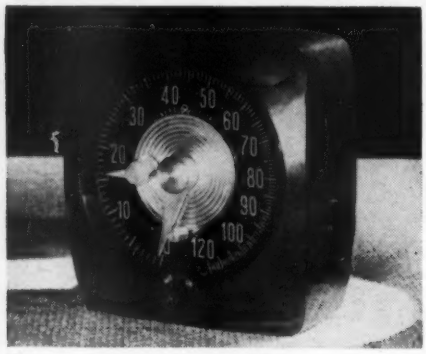
A COMPLETE RANGE OF FUSE DEVICES

A COMPLETE RANGE OF MULTI-BREAKERS

Executive Offices: 50 Paris Street, Newark 5, N. J.
Plants: Hartford, Conn., Newark, N. J., St. Louis, Mo., L. I. City, N. Y.
SALES OFFICES IN PRINCIPAL CITIES

Federal Electric Products Company, Manufacturers of a Complete Line of Electrical Products including Motor Controls • Safety Switches • Service Equipment • Circuit Breakers • Panelboards • Switchboards • Bus Duct

NEW EQUIPMENT



Interval Timer

A NEW automatic interval timer, type T-48, available in four models to fit a wide variety of applications for laboratory, home, and hobby, has been announced by Meter and Instrument Divisions of General Electric Co. Powered by a Telechron motor, the new timer operates on a 120-v, 60-cycle circuit, with a maximum load of 1,200 w. It is enclosed in plastic case and weighs 2 lb.

A triple action control knob permits manual or automatic operation. A control pointer for setting the desired time period and a timing pointer which measures off the cycle are made of anodized aluminum for durability. The dial is protected by a shatterproof plastic window.

At the end of any cycle, the timer resets automatically. Equipment to be controlled can easily be plugged into the inlet receptacle on the side of the case. Type T-48 timers are available to measure the following time intervals: 0-120 sec, 0-15 min, 0-2 hr and 0-12 hr.

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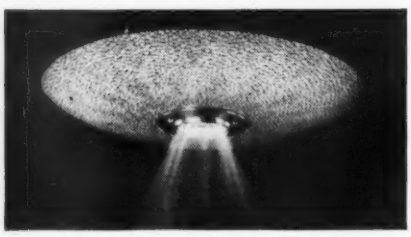


Pin-Point Lighting

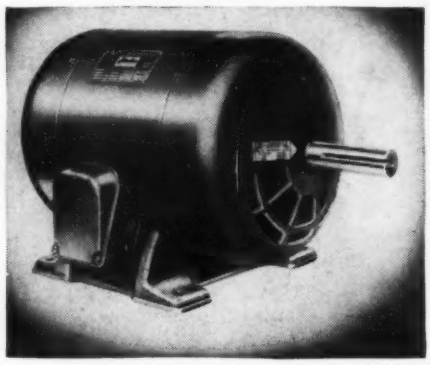
TWO-CIRCUIT WIRING and a central lens of clear glass are features of the ceiling fixture Advance Pacemaker, developed by Lightolier Inc, 11 East 36th St, New York, N. Y. Surrounding the lens is a white ceramic background etched in geometric patterns.

Three-way lighting is provided, either (1) pin-point or dramatic spot, (2) soft, over-all illumination or (3) a combination of both. The extra width (19½ in. dia) is reported to provide more illuminating area to spread the light evenly. Depth is only 4½ in.

•

Induction Motor

A SQUIRREL-CAGE induction motor of weatherproof construction for outdoor oil well pumping service is available from Westinghouse Electric Corp, Box 868, Pittsburgh 30, Pa. Ratings range from ½ to 15-hp in frames 224 through 326. The motor has steel frame, feet and end brackets.



The new Life-Line motor, type CSP, utilizes the self-sealed, prelubricated ball bearings that are said to provide effective lubrication for five years or longer without repacking. In addition, Tuffernell insulation is used with Tufvar wire.

The motors are available for 60 cycle, 3-phase, 220-440 v, 900-1800 rpm, 40 C rise, continuous duty, open NEMA designs B and C, and 50 C rise, continuous duty, open NEMA design D (5-8% slip), normal-torque, normal slip; high-torque, normal-slip; high-torque, 5 to 8% slip.

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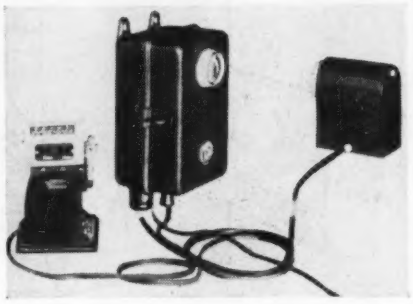
Photoelectric Counter

TYPE 20AP5 photoelectric counter has been designed for installation on conveyor systems or automatic machines. This general purpose unit is made available by Photoswitch Inc, 77 Broadway, Cambridge 42, Mass. The light source has an adjustable lens system which



permits narrowing the light beam for counting small objects.

A packaged unit includes light source, photoelectric control and electric counter. One or more electric counters may be located remote from the location where the count is being made. The unit plugs into a 115-v, 60-cycle outlet. Control device has a receptacle for plug from counter. Operating range is 6 ft between photoelectric unit and light source.

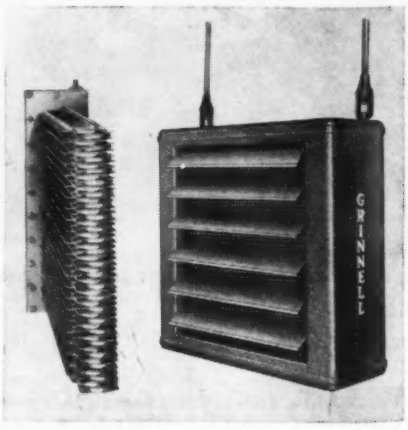
Speed of operation is up to 600 counts per min. Maximum number of counts is 99,999 before returning to zero. As to adjustment, counter may be reset to zero by turning reset knob.

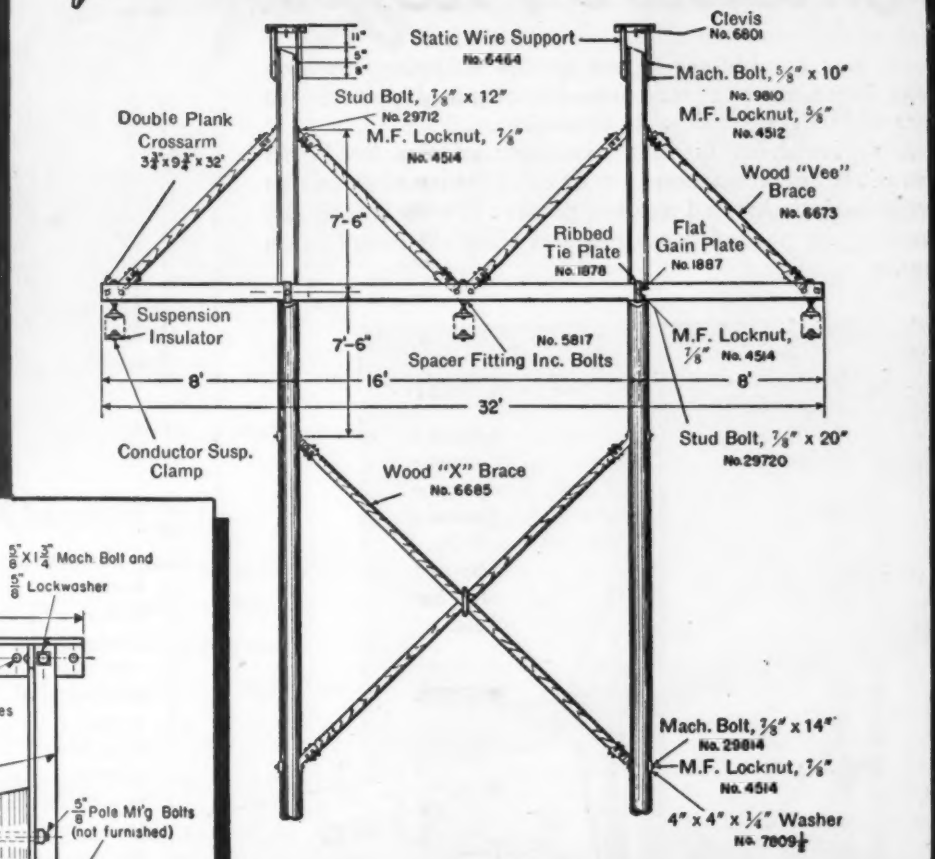
•

Unit Heater

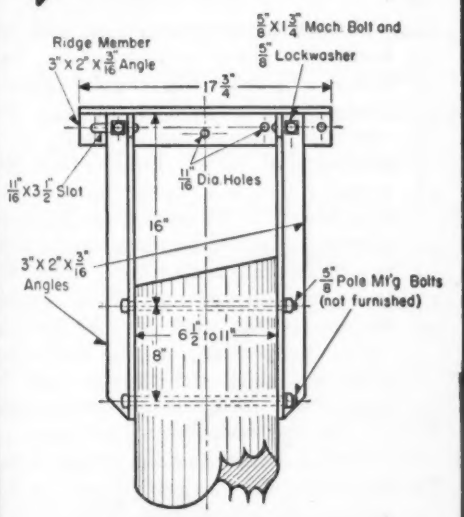
AVAILABILITY of its new textile Thermolier has been announced by Grinnell Co, Inc, Providence, R. I. Heat transfer surfaces are reported to have smooth contours. Removing lint, fly and dust from this heater is said to require only a jet of air from a compressed air hose or from a portable blower.

Unit is offered in one size with a heating rate of 113,700 Btu per hr using steam at 2-psi and entering air

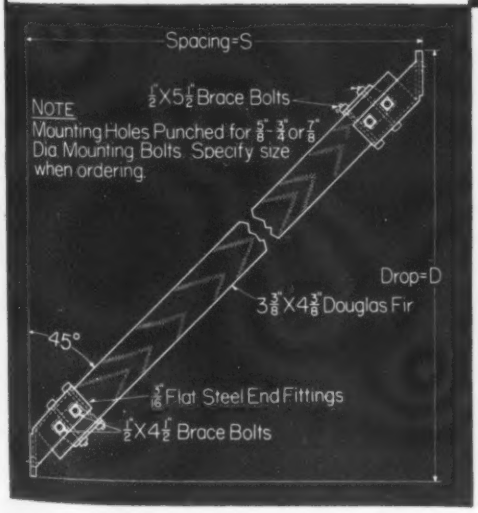




Typical Tangent Structure by HUBBARD



Static Wire Support
No. 6464


Spacing=S
NOTE
Mounting Holes Punched for 5/8", 3/4" or 7/8" Dia. Mounting Bolts. Specify size when ordering.
1/2" X 5 1/2" Brace Bolts
Drop=D
3 3/8" X 4 5/8" Douglas Fir
45°
1/8" Flat Steel End Fittings
1/2" X 4 1/2" Brace Bolts

Hubbard "Vee" Brace
No. 6673

The H-Frame shown above consists basically of two poles of proper height and classification for 69 to 161 KV construction to which are attached two 3¾" x 9¾" x 32-foot Fir Cross Arms. Poles are slab-gained to a thickness of 7½-inches so that factory-assembled crossarms may be used. A No. 6464 Static Wire Support is mounted on each pole-top and No. 6673 Vee Braces are used to give added strength to the structure. The No. 5817 Steel Spacer Fittings serve a multiple purpose. They space the plank arms, provide a mounting point for the Vee Braces and are the points of suspension for the Insulator strings. No. 6685 Cross Brace is used to give transverse strength to the structure.

For detailed bill of materials, see your Hubbard representative or write to Hubbard and Company.

HUBBARD AND COMPANY

PITTSBURGH
CHICAGO

OAKLAND,
CALIF.

Dependable Years of Service mean *Greater Profits*

No guess nor gamble when you specify Koppers *Pressure-Creosoted* Poles. Users report pressure-creosoted poles 30 to 40 years old still in serviceable condition.

Such *dependability* is your assurance of *Greater Profits* because of minimum maintenance costs . . . Prompt deliveries from conveniently located treating plants . . . Ample facilities for stocking all needed quantities and sizes for out-of-stock shipments.

KOPPERS

PRESSURE-TREATED WOOD

KOPPERS COMPANY, INC.

PITTSBURGH 19, PA.

at 60 F. Steam pressures up to 125 lb can be used.

Volume of air is 2438 cfm provided by a 1/6-hp motor-driven fan at rear of unit, which can be either manually or thermostatically controlled.

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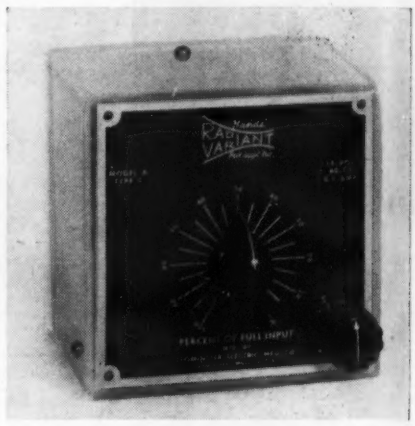

Infrared Bank Controller

AN INPUT CONTROLLER for infrared banks has been announced by Leominster Electric Mfg Co, Leominster, Mass. It is designed to vary the kilowatthour input to the lamps by interrupting the power input every few seconds. The percentage input is variable from 0 to 100 so that the temperature of a given work piece can be held at any desired temperature, other factors remaining constant. With suitable accessories, the work may be brought up to temperature at the maximum speed of which the radiant bank is capable and then held at that temperature for the desired length of time.

Known at the Radiant-Variant input controller, the device is rated at 0.1 amp at 115 v 60 cycles.

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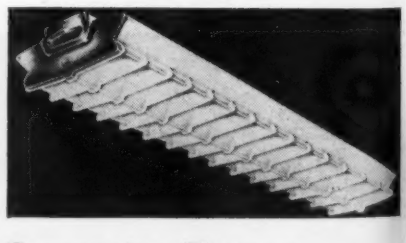


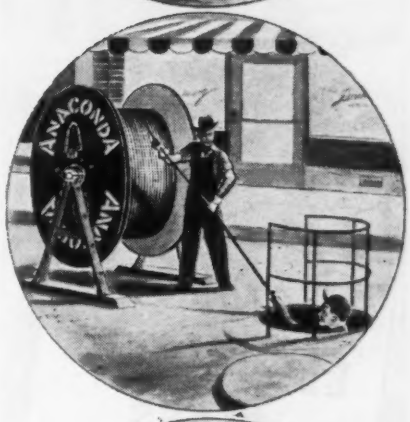
Companion Fixtures

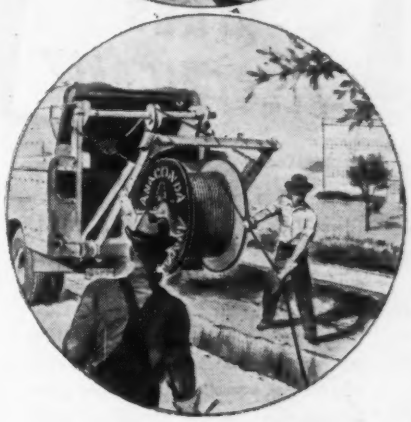
TWO COMPANION-TYPE commercial fluorescent fixtures feature low brightness ratio, and simplicity of installation and maintenance. They are a product of Day-Brite Lighting Inc, 5411 Bulwer Ave, St. Louis 7, Mo. Similarity of design of the two fixtures makes them adaptable to installations requiring flexibility of application.

Lenox-2 Unit (illustrated) accommodates two 48-in. 40-w lamps and has a V-shaped center louver. Lenox-4 unit is designed for four 48-in. 40-w lamps.

PICK ANY SPOT... THEN PICK

Durasheath





FOR POWER DISTRIBUTION, you can use a single type and size of Durasheath cable—whether it's small or large—one, two or three conductors—in runs that are in the air, in conduit or directly in the ground.

ADVANTAGES IN DURASHEATH:

High tensile strength and strong resistance to flame and abrasion.

Extreme flexibility that makes handling easy.

Resistance to moisture, acids and alkalies generally found in the soil.

No problems of electrolysis, corrosion and extremes in temperature.

Write for Bulletin DM 4820, "Durasheath, the All-Purpose Cable."

48479

ANACONDA WIRE & CABLE COMPANY

25 Broadway, New York 4, N. Y.

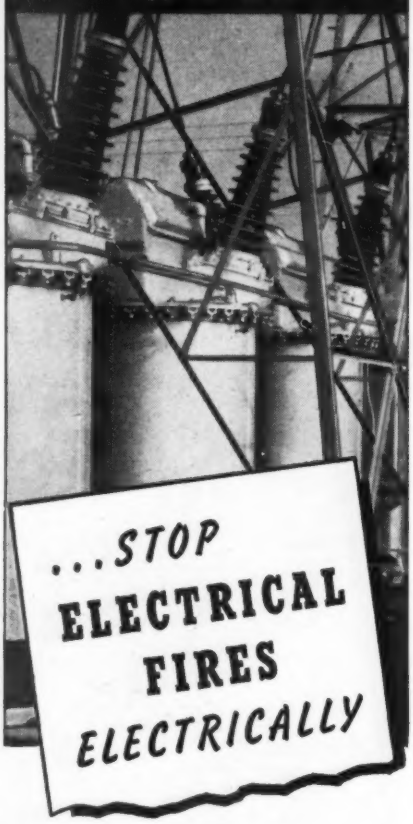
THE ALL-PURPOSE CABLE

Anacondaloy*-coated copper conductors are insulated with a moisture-resisting synthetic rubber compound, bound with color-coded rubber-filled tape and enclosed in a tough, high mechanical strength, moisture- and flame-resistant outer jacket of Neoprene. Conductors have the lasting protection of a solid block of synthetic rubber and Neoprene.

*Reg. U. S. Pat. Off.

ANACONDA
from mine to consumer

BLAW-KNOX
FIRE PROTECTION SYSTEMS



Blaw-Knox electro-thermostatically controlled fire protection systems *act instantly.* They respond to either abnormal rate of rise in temperature or to temperature above a fixed maximum. Valves, alarms, fire pumps, and other protective devices are activated *with the speed of electricity.*

Blaw-Knox Fog Nozzles are especially adapted to, and approved for, protection of transformer banks and similar installations.

Blaw-Knox Fire Protection Equipment is listed by Underwriters Laboratories, Inc. and approved by Factory Mutual Laboratories.

When writing, ask for Bulletin No. 2207

BLAW-KNOX
SPRINKLER DIVISION
of Blaw-Knox Construction Company
829 Beaver Avenue, N. S.
Pittsburgh 12, Pa.
Offices in Principal Cities

Its three longitudinal louvers are double-wall Boxco design. For both fixtures all the louvers and side panels are finished in baked Super-White enamel and the ends and hangers in baked lustre aluminum enamel.

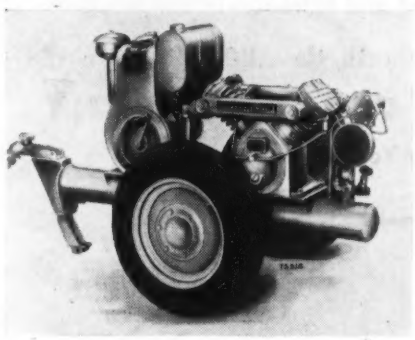
The chassis can be used for individual unit or continuous installations, and for either surface or suspension mounting. Each enclosure is mounted to the chassis by hand-operated spring tension clips.

•

Portable Compressor

THE PAC-AIR is a self-contained, air-cooled, gasoline - engine - driven utility unit recently added to the line of portable compressors built by Ingersoll-Rand Co, 11 Broadway, New York 4, N. Y.

The 2-cylinder, single-stage compressor has a piston displacement of 37.5 cfm at 80 psi. It is equipped with an automatic unloader. The compressor and engine are mounted on an air receiver which forms an integral part of the running gear. Pneumatic tires, 6.00 x16, and a ball-and-socket type trailer hitch are provided for towing service.



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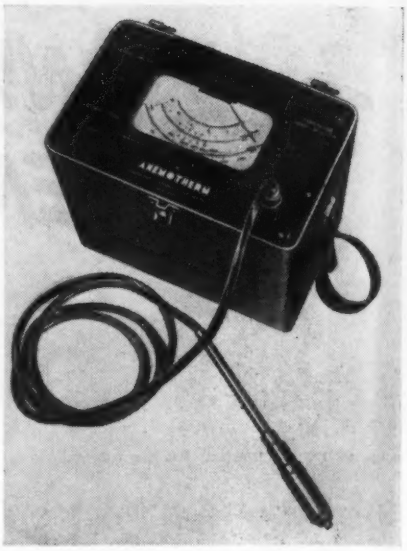
Motor Starters

DEVELOPMENT of Bulletin 4111, Size 1 a-c magnetic starters is announced by Ward Leonard Electric Co, Mount Vernon, N. Y. They are designed for nonreversing, across-the-line starting of polyphase squirrel-cage induction motors and single-phase motors.

These new a-c starters are available with open type construction or with NEMA Type 1 general-purpose enclosures. They are suitable for use with separate pilot devices for 2 or 3-wire remote control, or can be supplied with local control pushbutton stations or selector switches. Thermal overload protection is included.

Bulletin 4111 starters have a maximum enclosed rating of 7½ hp, 440-550 v, 3-phase, 60 cycles. Standard operating coils can be furnished for 110, 208-220, 440 and 550 v; 25, 50 or 60-cycle service. Dual voltage coils can be supplied for 110/220 or 220/440 v, 60 cycles.



Air Meter

ANEMOTHERM, a new three-way air meter which measures air velocity, air temperature and static pressure readings was recently placed on the market by Anemostat Corp of America, 10 East 39th St, New York 16, N. Y. It operates on self-contained batteries and weighs 11 lb. The probe is small and is attached to a long flexible cable.

The new meter measures air velocity from 10 fpm to 5000 fpm, and temperatures from 30 F to 155 F. Either negative or positive static pressure may be read directly in inches of water, from 0.05 to 10 positive and 0.05 to 4 negative.

•

MORE NEW PRODUCTS
about which you should know

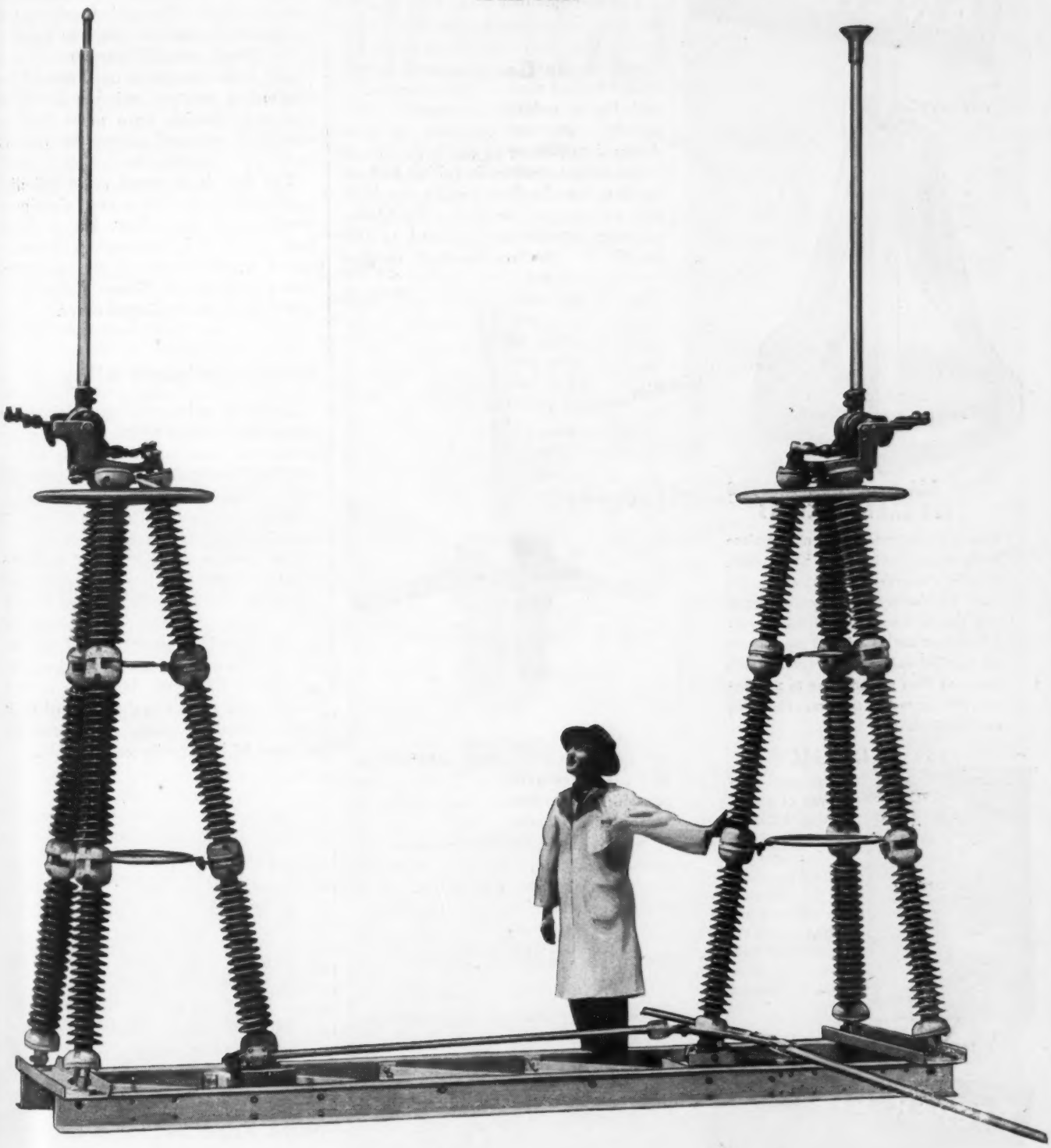
Wheeler Insulated Wire Co, Inc, Waterbury, Conn, produces a self-powered **telephone** (no batteries or power connection) with transmitter-receiver hand set and press-lever ringing signal for two-station, pair phone operation, and claimed to be effective in installations up to 20 miles.

Coral Designs, Box 248, Forest Hills, N. Y. has Cat. No. 104 sensitive static **pressure controls** in ratings ranging from 0 to 10 in. of water pressure and with differentials having a minimum of 0.2 in. water; electrical ratings: 10 amp, 125v or 5 amp, 250v, a-c. . . . Smithcraft Lighting Division, Chelsea 50, Mass, released the Eye-Q, a **fluorescent fixture** for two 40w lamps, with louvers; an all-steel unit without glass or plastic parts.

Cole Electric Co.

8439 Steller Drive — Culver City, Calif.

TExas 0-4701



AIR BREAK DISCONNECTING SWITCH
230,000 Volts—1200 Amperes—Type MV
Vertical Break—Three Pole, Single Throw
Group Operated
(One pole shown)

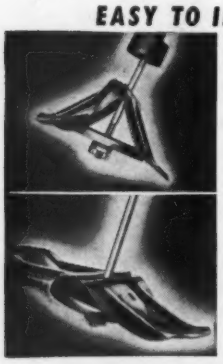
P-L*
EARTH ANCHORS

*REA APPROVED

P-L ALL STEEL, EXPANDING TYPE EARTH ANCHORS

Here is the first really efficient, two-piece earth anchor that is of simple, fool-proof, all-steel, heavy-duty construction. P-L Earth Anchors are exceptionally rugged and possess tremendous holding power. P-L Anchors can do a better job and can be installed quicker in all types of soil. Everyone from the engineer to the lineman can appreciate the ease of handling and installation.

EASY TO INSTALL



P-L Anchors come to you as assembled units. Built of two simple pieces of heavy steel plate. A few blows of the tamping bar and the sharp edged blades cut deeply and permanently into solid, undisturbed earth.

FOR LITERATURE WRITE

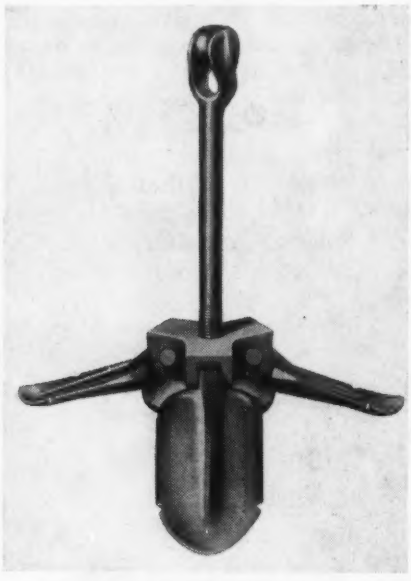
PIEPER-LILLARD
INCORPORATED
ST. LOUIS 1, MO.

Expanding Anchor

An expanding type, cone-slant anchor made of high-strength malleable iron and approved by the REA, has been announced by the Albion Malleable Iron Co, Albion, Mich.

The new albion-dillon anchor features three long, cone-slanted blades to provide maximum holding power. Tests have shown that the anchor will withstand a 46,000-lb pull.

For installaton a 3-in., 4-in. or 6-in. dia hole (depending on size of anchor) is dug with auger to desired depth. A strand of light wire is placed around blades to hold them in place (vertically, with blades pointing downward). The anchor, with rod attached, is then dropped to bottom of the hole. A few blows with a spud or installing tool on the large anchor top breaks the light wire and expands the blades. The blades advance outward and upward to full length in the undisturbed earth—



quickly becoming locked into position and ready for a full pull. Eighty percent of the total anchor area is expanded in the earth.

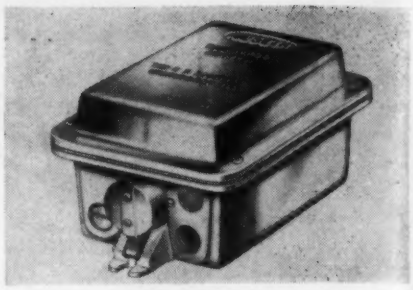
Models are available in three hole sizes, 3-in., 4-in. and 6-in., with two variations of blade spread available in the 6-in. size.

•

Remote Control Switch

A REMOTE CONTROL SWITCH for the operation of motors and yard lights has been introduced by M. B. Austin Co, Northbrook, Ill. Known as "Remotrol," it is designed for use with any number of momentary contact switches, thus eliminating the need for 3-way and 4-way switches, and reducing the amount of wire required.

Remotrol is built for indoor or outdoor use. Unit consists of a solenoid plunger-type ratchet switch which is



energized by operating a momentary contact switch. This action indexes the switch mechanism to complete the circuit. Circuit remains on, even though circuit is not energized until one of the momentary contact switches is again operated. Having once more become energized, solenoid moves the ratchet and breaks the circuit.

The unit is mounted on a bakelite panel and housed in a cast aluminum weatherproof case. Case has a drain hole, screened for protection. To safeguard against overload, the unit carries a replaceable 15-amp Fustat protected by a spring-hinged cover.

•

Plated Stainless Alloy

LUSTRALLOY is a new material in the plated metals field which is reported to permit the securing of uniform nickel plating without the use of electric current. The material has been made available by the Lustralloy Sales Corp, 10 East 52nd St, New York 22, N. Y.

The plating process is said to leave a bright finish that is tarnish and corrosion proof. It may be applied to any base metal. Uniform thicknesses on contours and recesses have been reported. Lustralloy may be hardened to as high as VPN 900. Hardness at that level is said to be equal to that of most hard chromium plate, and wear resistance to be equally comparable.

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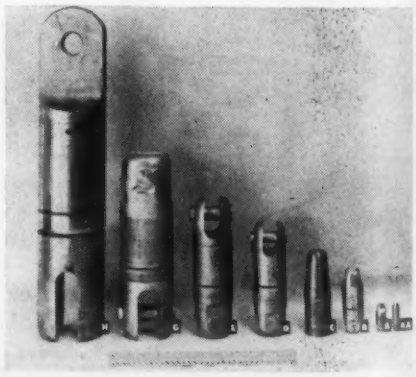


Wire Rope Swivel

TWIST AND LINE unlaying in wire rope can now be eliminated through use of Miller annular ball bearing swivels, designed and developed by General Ma-

chine & Welding Works, 1100 East Second St, Pomona, Calif. They find applications by telephone and power companies, in the oil fields, in construction work, and for industrial hoisting lines.

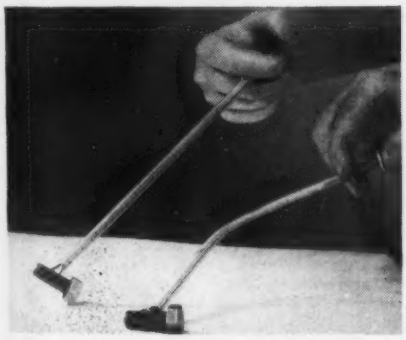
The patented design of the swivels is said to make possible the use of the entire bearing surface of three ball races. The bearings are protected from dirt and water by a heavy, grease packing, sealed when the swivel is assembled at the factory. Assembly is made under pressure to force all vacuum pockets from the bearing chambers.

The cadmium plated swivels are machined of high-strength steel in sizes comparable to wire rope (1-in, ¾-in, ⅝-in, etc) and are available in ten different styles such as hook and clevis, clevis and eye, swedge and stud, etc.

•

Pick-up Tool

FLEX-O-PIC, a specialty tool for hard-to-reach parts and places, has been put on the market by Emco Enterprises, Dept 55, 6750 Stony Island Ave, Chicago 49, Ill. It is said to be acid proof, cadmium plated and can be taken apart to be cleaned. The shaft is flexible



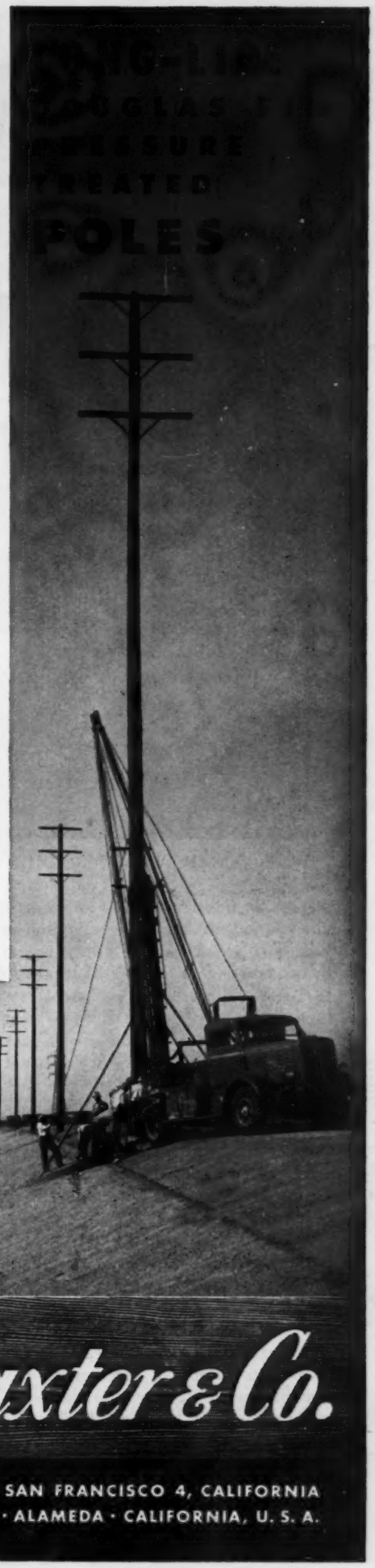
cable, such as is used in speedometers, and is encased in a housing with enough flexibility to work around corners or S-turns. Some uses are meter shops, battery shops, servicing of electronic equipment, automobiles and trucks. The tool is available in any size shaft for specific problems. The tool has expanding and retracting fingers which enable it to reach in and grab a tight hold on anything.

•

Metal Raceway

ADDITIONAL OUTLETS are provided by Plugmold Jr, a trim, 30-in. metal raceway complete with three standard receptacles, 6-ft cord and plug. It is produced by Wiremold Co, Hartford 10, Conn. Prewired, ready for plugging into an existing outlet, the unit can be attached to the surface by two wood screws.

BAXCO



In transmission lines–distribution, lighting or telephone systems–wherever dependable service is of prime importance you can count on Baxco Long-Life Poles to do the job.

Baxco Long-Life Poles are strong, straight, machine shaved, Coast-type Douglas Fir pressure treated with creosote and pentachlorphenol to resist rot, termites and deterioration.

You'll be proud of these poles in your line and more than satisfied with their long maintenance-free service. Write or wire us your inquiries.

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NEWS ABOUT PEOPLE

Doran Elected President, PEA at Annual Meeting

W. H. Doran, executive vice-president of the Metropolitan Edison Co, Reading, Pa, was elected president of the Pennsylvania Electric Association at the annual meeting held last week in Pittsburgh.

Mr Doran has been associated with

W. H. DORAN

the utility industry for 27 years and in that period of time has acquired a wealth of experience in utility operations. Starting in New York State in 1921 with the Depew and Lancaster Light & Power Co, he became new business manager for the New York State Electric & Gas Corp in Lancaster five years later. Subsequent positions with that utility included new business manager, western New York group; vice-president and manager, Lancaster division; vice-president and manager, Geneva division, and later of the Ithaca division.

It was in 1941 that Mr Doran was made vice-president of the Metropolitan Edison Co and in 1946 executive vice-president.

Becoming active in the affairs of PEA shortly after he went to Reading, Mr Doran was elected a member of the executive committee in 1944 and subsequent years. In the years 1945, 1946 and 1947 he was appointed adviser of the general section of the association organized to discuss, study and conduct research in various operating phases of the electric utility industry. He was elected a vice-president in 1946 and was reelected in 1947. In that year he was also appointed chairman of the finance committee. In addition to being interested in utility activities, he has always been interested in community progress.

•

C. S. Rich Named Editor, Electrical Engineering

Announcement has been made of the appointment of Charles S. Rich as editor of *Electrical Engineering*, published by the American Institute of Electrical Engineers, and of the AIEE *Transactions*, effective Oct 1.

Mr Rich has been secretary of the AIEE technical program committee and of the committee on the award of Institute prizes since 1930. Previously, he had been identified with the U. S. Leather Co as district engineer of the southern district. Mr Rich is a graduate of Cornell University, class of 1926.

•

▶ CLARENCE S. COLE, superintendent of electrical and mechanical maintenance for the Niagara Falls Power Co, Niagara Falls, N. Y., has been promoted to assistant general superintendent of the company. He succeeds Charles A. Clancy, who was recently transferred to the Canadian subsidiary (EW Sept 18 p 28). DANIEL W. BROWN, who has been chief electrician for the company, has been named superintendent of electrical and mechanical maintenance, succeeding Mr Cole.

▶ G. E. ROBERTSON, formerly chief of plants in the Little Falls Division of the Minnesota Power & Light Co, Duluth, has been appointed superintendent of hydroelectric generation for the company. Mr Robertson succeeds WILLIAM EVANS, retired. Mr. Robertson's connection with the company began in 1912, and Mr Evans' 32 years ago.

▶ C. A. BREWER, formerly manager of the Pend Oreille Electric Cooperative at Newport, Wash., has been named manager of the Citizens Utilities Light Co at Deer Park, Wash. He had been at Newport since the first of the year, previously having been electrical engineer for a rural electrification group at Glasgow, Mont.

Morrin Directs Electrical Research at Stanford

Thomas Morrin has been appointed chairman of electrical engineering research at Stanford Research Institute, Stanford, Calif. Before joining the Institute staff, Mr Morrin was chief of the microwave engineering department of the Raytheon Manufacturing Co, Waltham, Mass.

His early experience was with the Westinghouse Electric Corp in switchboard equipment control and the Pacific Gas & Electric Co in transmission, distribution and coordination of communication and power line systems operations.

During World War II he served for

T. MORRIN

four years aboard the USS Pennsylvania, first as radio officer and later as communications officer. In 1945 he was assigned to the New England area as Navy liaison officer, with the rank of lieutenant commander, between the National Defense Research Council and special laboratories doing Navy research work. The following year he was made commanding officer of the Office of Naval Research in Boston, where he represented the Navy in technical control and administration of all research contracts in the area.

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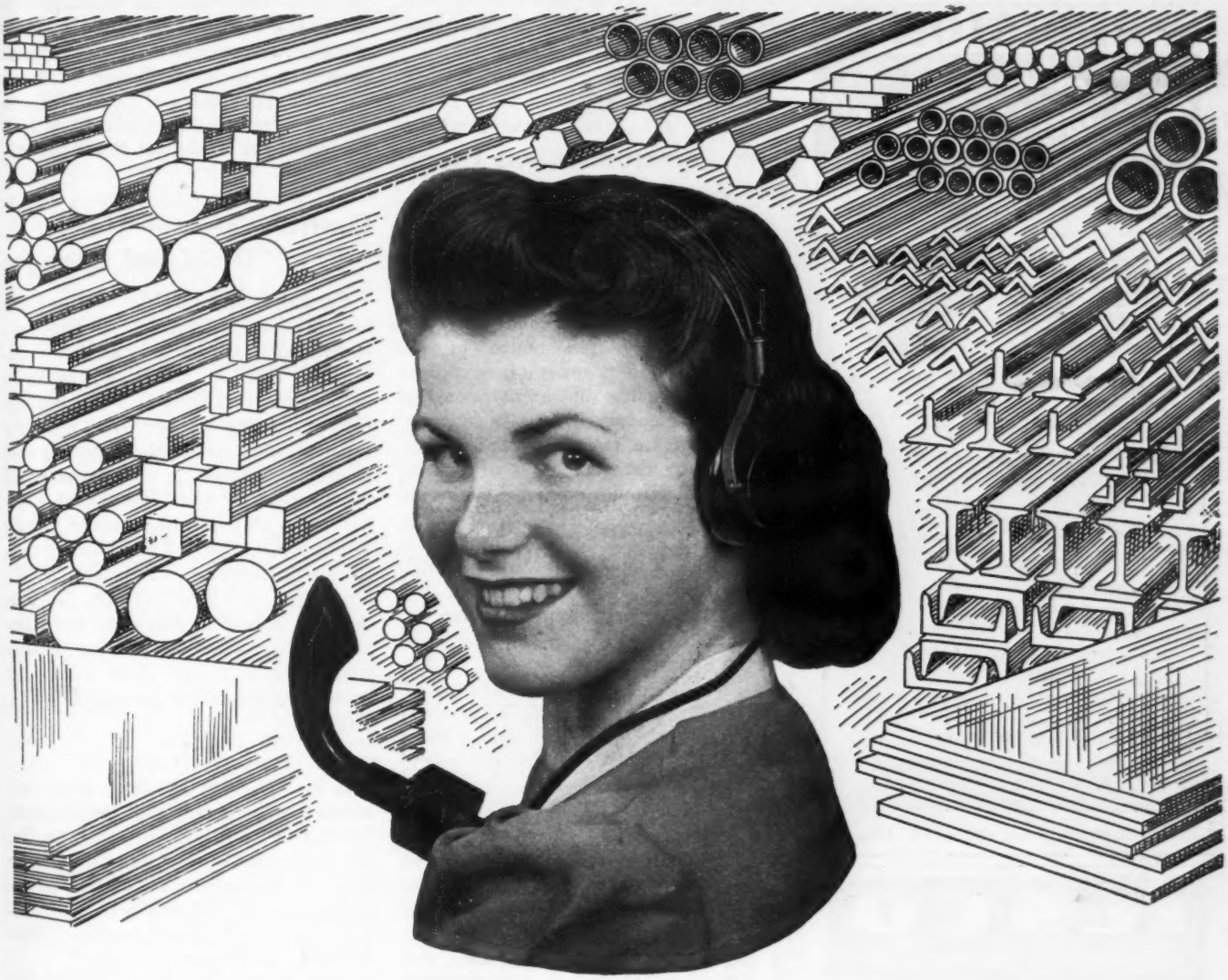
▶ LEANDER W. MATSCH has been appointed professor of electrical engineering at Illinois Institute of Technology. Since 1945, he has been a supervisor in electrical engineering research at Tech's Armour Research



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VIBROTEST for insulation resistance testing. 36 models to meet all requirements. Self-contained, portable, no leveling or cranking. Push button operation with safety features incorporated. Accurate at —40 to +140 degrees F.

HYPOT insulation breakdown and short tester. Discriminates between leakage breakdown. Voltage variable from 0 to 4000 volts AC. Fully grounded, portable, self-contained. Reads actual secondary voltage applied. Red light warns when energized. Shielded leads.

PHASE SEQUENCE INDICATOR

shows order of sine wave voltage sequences. Compact, easy to use, no moving parts. 110, 220, 440 volt ranges on one switch. Two indicator lights simply marked. Weighs less than 1 lb.

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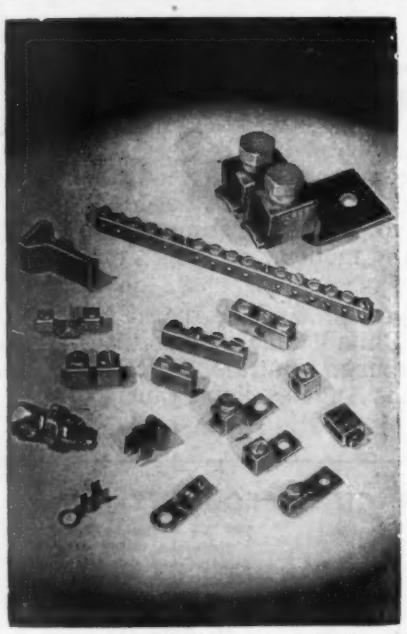
Electrical Connectors



MANY TYPES AND SIZES
WRITE for 54-page illustrated catalog.

ILSCO COPPER TUBE & PRODUCTS, Inc.
CINCINNATI, OHIO

Foundation. For 18 years prior to 1945, he was an engineer with the Commonwealth Edison Co.

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Utility Assigns New Duties in Communications Group

J. G. McKinley, electronics engineer for the West Penn Power Co at Pittsburgh, has been appointed system communications engineer, succeeding R. S. Cooper, who has retired after 41 years of service with the company. Mr McKinley has been active in all branches of the company's communication system since his employment in 1922. He has been especially active in the engineering, installation and servicing of more than 200 units of various kinds of electronics equipment now installed over the system. In addition, he brings to the communications group considerable experience in national communications activities. Credit for the well-built coordinated system of communications maintained by the West Penn System is largely due to Mr Cooper's efforts. He initiated many of the new ideas and modern developments in communications, among them the safety phone used by the power company's line crews.

R. M. Armstrong, of Charleroi, is being promoted to the position of electronics engineer. He will continue to serve as field engineer in the installation, maintenance and testing of company-owned communication equipment.

As facilities are made available, the headquarters of the communications group will move from Connellsville to Charleroi. Mr McKinley, however, will continue to make his headquarters at Pittsburgh. Supervision of the group for administrative purposes will be directed by H. F. Kelso, operating practices engineer, whose headquarters are at Charleroi.

•

▶ R. N. MIERS has been named manager of the sales section of the steam turbine department of the Allis-Chalmers Mfg Co, Milwaukee, Wis. He succeeds W. F. DALY, who has been appointed manager of the company's Cincinnati office. Mr Miers has been associated with A-C's steam turbine department since joining the company in 1928.

▶ HOBART C. MCDANIEL has been appointed manager, Technical Press Service in the Public Relations Department of the Westinghouse Electric Corp, Pittsburgh, Pa. He will be responsible for the company's publicity in the technical and trade magazines. Mr McDaniel succeeds CARL E. NAGEL, who has resigned to join the McGraw-Hill Book Co in New York. A graduate in lectrical engineering of Oregon State, Mr McDaniel joined the Westinghouse Lamp Division in Bloomfield, N. J., as commercial engineer in 1939. Previous connections included Pacific Power & Light Co, Portland, and Central Illinois Public Service Co, Springfield. In 1943 he joined the Technical Press Service.

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Central Vermont Makes Divisional Changes

Central Vermont Public Service Corp has transferred the following divisional superintendents to new locations: Frederick G. Baldwin, from Bennington to St. Johnsbury; Hiram C. Rich, Springfield to Bennington. Lee Gray, formerly superintendent in the St. Johnsbury and Bradford divisions, is now manager of the Lyndonville (Vt.) Municipal Electric Light Department. Arthur Duval, Windsor, has assumed additional duties as superintendent in Claremont, N. H., succeeding the late Herbert G. Ducharme. Albert F. Davis, of the company's distribution engineering department, Rutland, has been appointed superintendent of the Springfield (Vt.) division.

•

▶ C. F. MCGINNIS has been appointed assistant sales manager of the Ridgway Division of the Elliott Co, Jeannette, Pa. Mr McGinnis has been with Elliott since 1936. He has been in the electric power department at Ridgway and was also manager of the Kansas City office before returning to Ridgway last year.

▶ THOMAS W. DELZELL has been named chairman of the board of directors of the Portland General Electric Co, Portland, Ore, successor to the Portland Electric Power Co. During the long period of Pepco reorganization. Mr. Delzell served as independent trustee. Previously he was connected with the California Oregon Power Co. WALDEMAN SETON has been appointed vice-president in charge of administration of Portland General Electric. He joined the company in 1927 and served in various managerial capacities. He was treasurer at the time of his advancement to the vice-presidency.

▶ DEAN EDGAR A. LOEW has retired as dean of the University of Washington college of engineering, but will continue on the faculty as professor of electrical engineering. Retirement from executive positions is mandatory at the age of 65. He will be succeeded by DR HAROLD E. WESSMAN, who has been chairman of the civil engineering department at New York University for 11 years. Dean Loew joined the faculty in 1909 and has been dean for 13 years. He has been active in both local and

national affairs of the American Institute of Electrical Engineers and has written some 40 articles and two textbooks.

▶ PHILIP D. REED, chairman of the board of the General Electric Co, has been named chairman of the United States group to sit on the new United States-British Council on Productivity. The council probably will meet in London late in October.

▶ CHARLES A. SLACK, formerly manager of the New York office, Robbins & Myers, Inc, Springfield, Ohio, has been named sales manager of the motor division.

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OBITUARY

▶ ALDUS C. HIGGINS, chairman of the executive committee of The Norton Co, and of the board of directors of the Riley Stoker Corp, died at Worcester, Mass, on Sept 11. He was 75 years old. A graduate of Worcester Polytechnic Institute, Mr Higgins practiced patent law in his early career and was president of The Norton Co from 1933 to 1946. He received an honorary doctor of engineering degree from his Alma Mater in 1931.

▶ ARCHER K. JONES, long identified with the electric utility industry in Cuba and Chile and later in Florida, died on Sept 6 in Miami as the result of a heart attack. He was 65 years old. Mr Jones retired last June as administrative assistant in the executive department of Florida Power & Light Co. He was a life member of AIEE. Before going to Miami in 1938, Mr Jones was president and general manager of the Chilean Electric Co and prior to that connection he served as president and general manager of the Cuban Electric Co, Havana.

▶ RAYMOND E. PATTEN, director of the appearance design division of the General Electric Co, died on Sept 13 in Norwalk, Conn. He was 51 years old. Mr Patten had been with GE since 1928. Born in Malden, Mass, he attended Harvard University and the Massachusetts Institute of Technology. Before his association with General Electric, he had been connected with the research laboratory of the General Motors Corp.

▶ ROBERT H. WILDER, a retired electrical engineer, formerly with Stone & Webster and the Pearson Engineering Corp, New York, died on Sept 11 in New York after a long illness. He was 62 years old.

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IF you need creosote for pressure-treating wood, just send an SOS to Koppers, and we'll ship your requirements. And you'll look just as happy as the man above, because you'll get the same high-quality Koppers Creosote you've always known.

When you order Koppers Creosote (or Koppers Creosote-Coal Tar Solutions), it's important to remember that you're getting products that have decades of dependable performance behind them . . . that have established enviable records as wood preservatives everywhere.

Send in your order now. And if you want to *play safe*, ask about Koppers yearly contracts that take care of your future needs.

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All Standard Specifications
For All Types of Wood Preservation

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MANUFACTURERS and MARKETS

FIRST UNIT POWER PLANT built at the Westinghouse Electric Corp plant at Sunnyvale, Calif., is tested under observation of representatives of its purchaser. The 5,000-kw plant will be installed on the system of the Comision Federal de Electricidad of Mexico. Five similar units are on order from Mexico, and Central and South American countries have ordered 18 others. Left to right are George Gayer, Westinghouse manager of engineering, Sunnyvale; Teodoro Schumacher, Enrique Chicharro, Leonardo Luna, all of the Comision; T. Albarran, Comision secretary; J. H. Pfrommer and R. L. Jeans, Westinghouse International

Electrical Manufacturers Announce More Increases in Prices and Wages

Price increases on several household appliances manufactured by General Electric Co have been announced by C. R. Pritchard, manager of marketing in the GE appliance and merchandise department. Appliances, which are affected by the increase include several models of refrigerators, ranges, water heaters and an automatic washer and drier. All increases are effective immediately, except on the automatic washer, which becomes effective Oct 1. The company had previously announced a reduction of approximately 15% in the price of sunlamps. The price dropped from $9.95 to $8.50.

Mr. Pritchard stated the appliance increases were caused by higher costs of materials, parts and freight. Refrigerator prices are now 3.7% to 5.7% greater, although the average increase is 2.4%. Prices of ranges rose 3.9% and water heaters 2.3%.

Allis-Chalmers Manufacturing Co has granted a 9-cent raise to 10,000 production workers at its West Allis, Wis, plant. It is retroactive to June 21, when 23,000 employees in other unions accepted the raise. The wage boost went to workers represented by the United Auto Workers, CIO.

Bakelite Corp announced last week that, effective Oct 1, it is revising its pricing structure to provide for sale of all its products at uniform delivered prices. The products include all Bakelite and Vinylite plastics products. Up to the present the company has shipped its products under several different policies, including shipment at prices f.o.b. Bakelite Corp plants, f.o.b. the customer's plant, and at prices including freight allowances. Company officials stated that it was difficult on short notice to state with reasonable accuracy the effect of the new price schedules on average price levels.

Citing steadily rising manufacturing costs, SKF Industries, Inc, announced that it will increase prices, effective Oct 1, on most of the company's products. While the price changes will not be uniform over the wide range of antifriction bearings produced by the company, the increases will average less than 10%, R. R. Zisette, general sales manager, explained. "These changes are barely sufficient to cover the increases in cost which we are experiencing from day to day," he said.

Federal Telephone & Radio Corp, Newark, N. J., has granted a four-cents an hour "across the board" wage increase to two groups of employees. The new wage agreement with Local 447, United Electrical Workers of America (CIO) and Local 204, United Office and Professional Workers of America (CIO) is retroactive to Aug 9. This four-cent an hour increase is in addition to the seven-cent an hour boost granted on Apr 1. The agreement extends the termination date of the present contracts from Apr 1, 1949, to Aug 9, 1950, with a reopening for wage talks on Aug 9, 1949.

Announcement has been made by Electromaster, Inc, Mount Clemens, Mich., of an advance of approximately 5.2% in prices on its line of electric ranges, effective Sept. 1.

Commenting on the price adjustment, Gerald Hulett, vice-president, said "several factors combine to make this price advance inevitable. The third round wage increase; the recent jump in the price of steel and wire; the substantial boost in freight rates, make it impossible for us to absorb the spiraling cost at our former prices."

An increase of three cents per hour, effective Sept 6, was also announced for all hourly wage employees of the company. The raise was made in accordance with the company's June 1, 1948, agreement with the International Brotherhood of Electrical Workers, (AFL).

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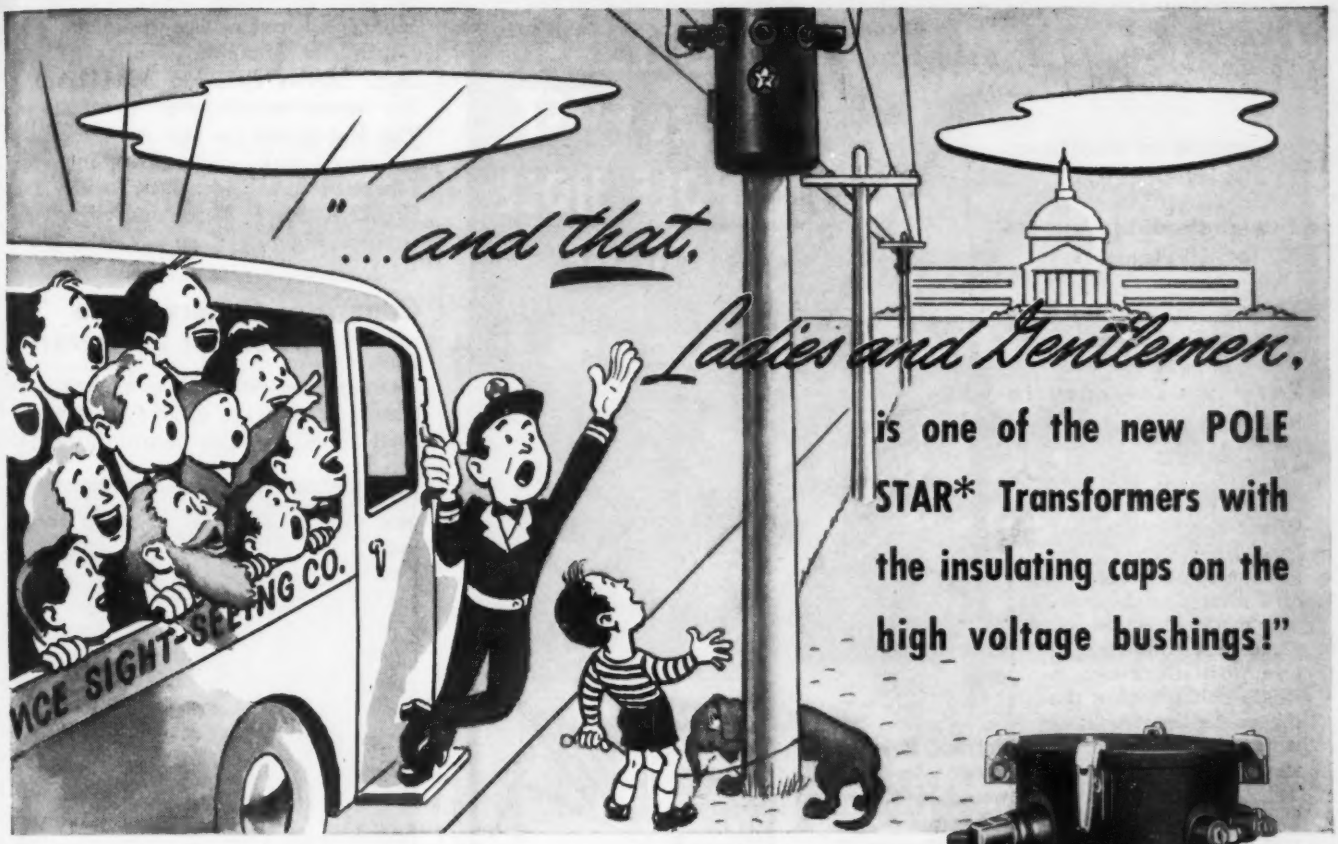
Videon, Inc, Organized

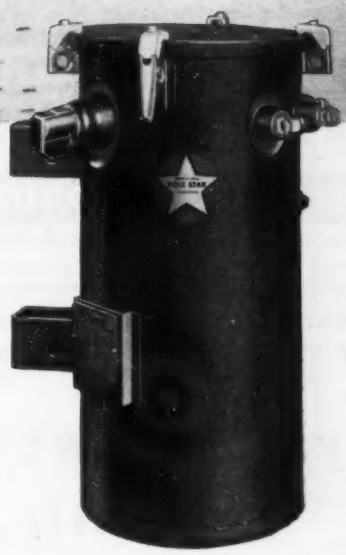
Announcement has been made of the organization of a new lighting fixture company, Videon, Inc, with offices in New York. Officers of the company are: David M. Goldring, president;


"...and that,
Ladies and Gentlemen,
is one of the new POLE STAR* Transformers with the insulating caps on the high voltage bushings!"
VICE SIGHT-SEEING CO.

Yes, ladies and gentlemen, that's Pennsylvania's new, postwar, Distribution Transformer; new in design — new in appearance — new in performance.

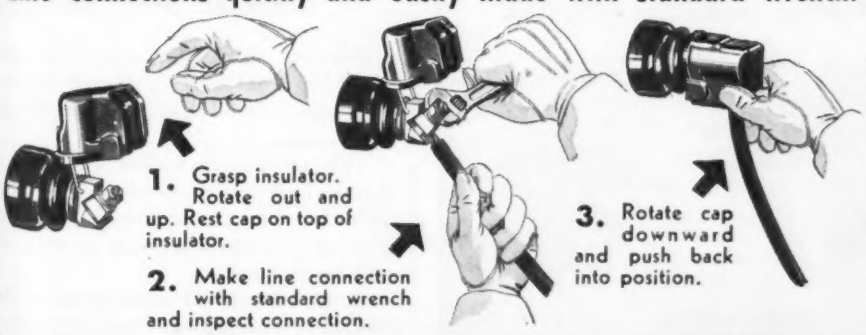
Consider the stud type, sidewall-mounted, high voltage bushings. They are a departure from the pocket bushings that were introduced years ago when bushings were not weatherproof. Now, with the present day bushings employing stud type terminals and gasket seals, Pennsylvania eliminated the pocket and pocket bushings because it felt that they no longer served their original purpose. Furthermore, the smaller, sturdier, straight, sidewall bushings have greater inherent strength than the curved, gooseneck bushings; and they take up less projected floor space.

Rugged, streamlined insulating caps completely cover bushing terminals for an added measure of safety. Insulating caps are attached to the bushings and swing in and out of position on non-corroding, spring wire hinges. Heavy bronze alloy solderless connectors are designed to allow line leads to issue at a downward angle. This facilitates installation when replacing pocket type bushing transformers with the new POLE STAR Transformers.



Embodying a new wound core design with an inherent low exciting current, POLE STAR Transformers are made in sizes 25 Kva and below, 14400 volts and below, single phase, 60 cycles, OISC, conforming to EEI-NEMA Standards.

Line Connections quickly and easily made with standard wrench.


1. Grasp insulator. Rotate out and up. Rest cap on top of insulator.
2. Make line connection with standard wrench and inspect connection.
3. Rotate cap downward and push back into position.

*P.S. let the POLE STAR be your guide

Product Of Long Experience — Safe Thrifty And Reliable

PENNSYLVANIA POLE STAR TRANSFORMER

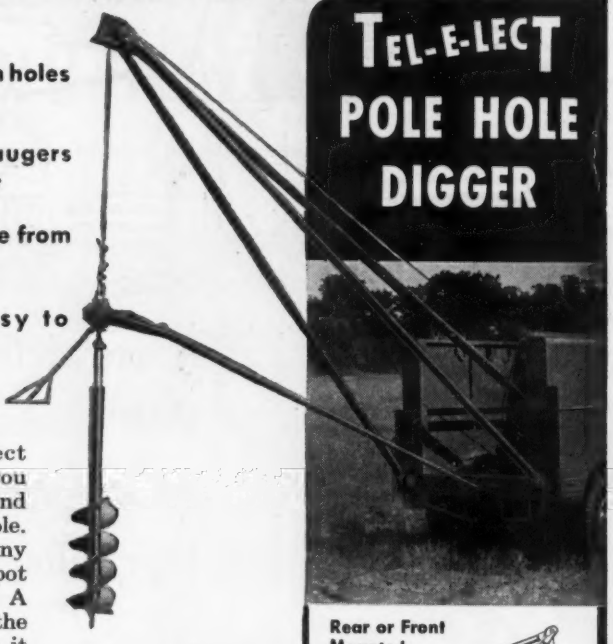
Pennsylvania TRANSFORMER COMPANY

PITTSBURGH 12, PENNSYLVANIA

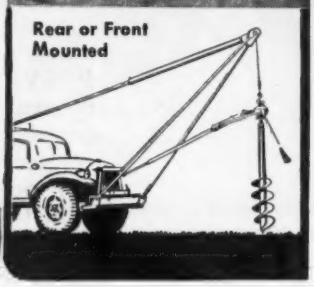
Operates **ON ANY DERRICK TRUCK**

TEL-E-LECT POLE HOLE DIGGER

- **Adjustable for clean holes to 8 ft. deep**
- **Interchangeable augers 9" to 16" diameter**
- **Drills a straight hole from any truck position**
- **Easy to use—easy to transport**



WITH the Tel-E-Lect Pole Hole Digger, you use the same truck and crew that sets the pole. You can drill a hole any place that you can spot the pole derrick. A single bolt attaches the digger to the truck; it works suspended from the derrick. Powered by the truck motor through a power take-off shaft, Tel-E-Lect is raised and lowered by the winch line. Fits the budget of even the smallest utility, and quickly pays for itself. *Ask for circular.*



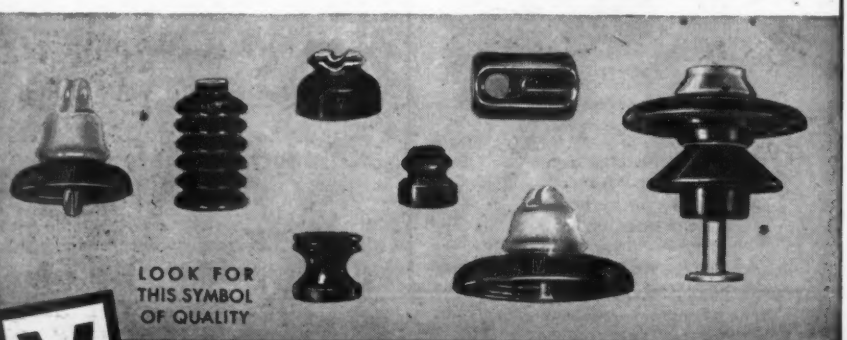
TEL-E-LECT PRODUCTS, Inc.

9602 MINNETONKA BOULEVARD, MINNEAPOLIS 16, MINNESOTA

ANOTHER STEP IN THE PROGRESS AND GROWTH OF VICTOR...OUR NEW, MODERN KILN NO. 3...

For DEPENDABLE Insulators Specify VICTOR

HIGH tension porcelain insulators made at Victor have passed the most *severe* tests on countless types of installations during the past 50 years. For safety, service and satisfaction, specify "Victor." We are doing our utmost to maintain dependable deliveries.



LOOK FOR THIS SYMBOL OF QUALITY

V

VICTOR INSULATORS, Inc., Victor, N.Y.

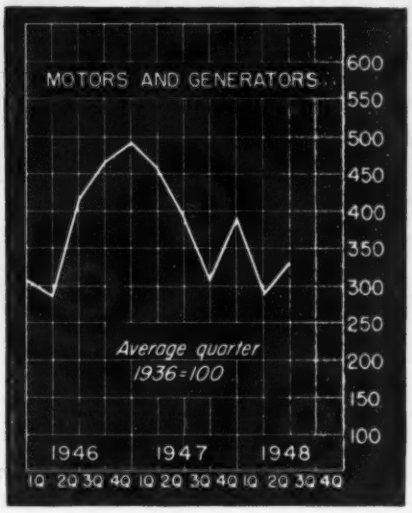
BIRTHPLACE OF FIRST WET PROCESS HIGH-VOLTAGE INSULATORS

Milton Liberman, vice-president, and Edwin R. Manning, secretary-treasurer. Messrs Goldring and Manning are former members of the staff of The Holophane Co and were recently associated with Gruber Bros, Inc. Mr Liberman was identified with the Brooklyn Navy Yard and with the Gotham Lighting Corp.

•

Generator Orders Move Upward in 2d Quarter

Orders received for motors and generators during the second quarter of 1948 moved upward, according to figures released by the National Electrical Manufacturers Association. The index compiled by NEMA advanced to 329 from 295 in the first quarter, an increase of 12%.



In 1947 the index stood at 394 for the second quarter, this year's figure representing a decrease of 16%.

No adjustment for cancellations has been made in 1946 and 1947, nor for renegotiation of contracts.

•

Admiral Corp Acquires Pressed Steel Division

Admiral Corp, Chicago, has purchased the domestic appliance division of Pressed Steel Car Co, Inc, Hegewisch, Ill.

This acquisition makes available to Admiral all of the electric range manufacturing facilities of Pressed Steel including equipment, certain inventories, and trade names.

Pressed Steel will concentrate on the output of railroad cars and equipment.

•

Sets Up Repair Service

Larkin Transformers Division of Larkin Lectro Products Corp, New York, has announced the opening of a newly formed transformer repair department.

RECENT RATE CHANGES

SOUTHERN NEVADA POWER CO, Las Vegas, has put into effect rate savings totaling $250,000 annually with the approval of the State Public Utilities Commission. Residential customers will save the larger share, $104,000, while commercial customers will save $69,000 and power users $64,000.

VIRGINIA ELECTRIC & POWER CO has eliminated the 5% discount on commercial and industrial electric bills and on certain miscellaneous business, effecting an increase of about $1,300,000 annually in electric revenues. This estimate is based on the present level of electricity usage. The discount had been in effect for one year. Stressing the company's needs for additional revenues to offset higher fuel and labor costs, J. G. Holtzclaw, president, said that effective with August billings, a fuel clause had been made effective on one commercial lighting rate which would increase revenues by about $300,000 a year. A fuel clause already is effective on practically all industrial power rates.

BUFFALO NIAGARA ELECTRIC CORP has filed with the New York Public Service Commission an application to discontinue the flat rate water heating schedule in Niagara Falls, Lewiston, Youngstown, Niagara and Porter. At present the company's service classification has set a flat rate, which allows consumers to have electricity for water heating at a rate lower than those charged to general consumers for other residential uses of electricity.

SAVANNAH ELECTRIC & POWER CO has applied for rate increases amounting to $374,000 a year with the Georgia Public Service Commission. The increase requested is 24.6% in water heating rates; 11.2% in residential and 10.7% in commercial rates. The application stated that the company is not earning a fair return on its investment.

COLUMBIA, MO., City Council has announced that rates for electric service will be increased from 10 to 26%; for water service, 20%; for bus fares 25% and for city taxes, 25%. It is expected the increase will provide $180,000 annually more in electric light and power and water revenues; $35,000 in city bus revenues and $30,000 more in city tax revenues. The city council also announced that wholesale consumers of electric power will pay $28,000 annual increase in the future. Higher rates are imperative because of the increased cost of city government, as well as a retirement fund for the $1,500,000 bond issue for improvement of the municipal water and light plant.

ELIZABETH CITY (N. C.) PUBLIC UTILITIES COMMISSION has adopted committee recommendations to discontinue the summer relief power rate and to adhere to established rates. Discontinuance of the summer relief rate means that customers who spend several months of the year out of town and retain their electrical service will no longer be allowed to let the power used on occasional visits home accumulate until the end of the period when they return home. They will now have to pay the minimum rate of $1.20 a month or else have their power cut off while they are away and then pay the dollar charge to have it cut on again.

Here's something new and better — and at no increase in cost! COLLYER POLYETHYLENE INSULATED LINE WIRE is so superior to conventional triple braid weatherproof that it promises to gain complete acceptance for all future installations. Check Polyethylene's electrical and mechanical advantages . . . they mean extraordinary performance, life, and dependability in any weather, for any line service . . . always!

★ **HIGHER DIELECTRIC STRENGTH**

Comparative tests of #6 solid line wire:

	NEW MATERIAL	AFTER 28 MONTHS' WEATHERING
Triple Braid Weatherproof	2,800 volts	800 volts
2/64" Collyer Polyethylene	**29,000 volts**	**No Change**

★ **GREATER RESISTANCE TO ABRASION**

Comparative tests on duPont Abrader show Collyer Polyethylene has greater abrasion resistance than Triple Braid Weather-proof or even Neoprene or Rubber Jackets.

★ **LIGHTER WEIGHT (for longer spans and minimum sag)**

Comparative weights #6 solid line wire:

Triple Braid W.P. 112 lbs. per 1000 ft.

Collyer Polyethylene 88 lbs. per 1000 ft.

★ **SLIMMER, TRIMMER AND LONGER LIVED**

Virtually unaffected by weathering — air, sun, water. Never festoons. Smaller diameter means less ice and wind load.

★ **FASTER TO WORK. EASIER TO SPLICE**

Strips clean in one operation.

Write today for samples and information.

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1. Controllers for Electric Motors

By H. D. James,
Consulting Engr.
and L. E. Markle,
Design Engr.

324 pp., 276 illus., $4.00

Here's a book spotlighting methods for getting the maximum power and use out of electric motors. It covers all types of commercial motor controls . . . describes their construction, performance, operation and maintenance. A special section is devoted to electron tube control, variable frequency, hydraulic gear, etc.

2. Trigonometry Refresher for Technical Men

By A. Albert Klaf

Civil Engr., Board of Water Supply, NYC
629 pp., 355 illus., $5.00

This book thoroughly covers plane and spherical trigonometry, as well as practical everyday problems in mechanics, surveying, electricity, physics, hydraulics and the construction of trigonometric tables. Logarithms are developed in a progressive style while the principal functions of an angle are explained in a new easy-to-understand way.

3. Principles of Radar

By members of the staff,
M.I.T. Radar School,

887 pp., 565 illus., $5.50

Completely revised, this book is valuable not only to those interested in radar, but also those concerned with ultra-high frequencies, microwaves, television, pulse-time communication systems, or pulse navigation systems. The easy-to-follow explanations of circuit operation are based on physical concepts and a wealth of numerical examples.

4. Industrial Electronic Control

By W. D. Cockrell,
Indus. Eng. Div., General Elec. Co.

247 pp., 175 illus., $2.75

Brings to every electrical man a working knowledge of industrial electronics for the effective selling, installing, and servicing of electronic equipment. In non-mathematical fashion it covers the fundamentals of electron tube operation as well as the basic applications of the tube in industrial control apparatus. Includes valuable information on the color code, ohmic values of resistance and reactance, photoelectric phenomena, etc.

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NEW ELECTRICAL CONSTRUCTION

A weekly selection of U. S. electrical construction projects announced by private and government utility systems involving more than $70,000. Also listed are major industrial and construction jobs where electrical work is indicated or implied

UTILITIES

Proposed Construction

Alabama — Wiregrass Electric Corp., Hartford, 133 mi. rural distr. lines and sys. imprvs., Geneva Co. **$375,000.**

Colorado—Kit Carson Electric Assn., Burlington, 90-mi. transmission lines and 1,025 mi. rural distr. lines, generating plant, four kw. generating units, Colorado 39 ABC Kit Carson. **$3,575,000.**

Georgia—Altamaha Electric Membership Corp., Lyons, 656 mi. rural distr. lines, sys. imprvs., headquarters facilities, Toombs Co. **$1,190,000.**

Kansas—Twin Valley Electric Co., Altamont, 384.17 mi. rural distr. lines in Labette, Montgomery, Neosho and Cherokee Counties, $375,000, Frank Horton & Co., Lamar, Mo., engrs.

Michigan—Presque Isle Electric Co-operative, Onaway, 89 mi. 44 kv. transmission lines, Presque Isle Co., $150,000. J. & G. Daverman Co., 3 Keeler Bldg., Grand Rapids, Zone 2, engr.

Nebraska—Southwest Electric Membership Corp., Palisade, rural distr. lines, Hayes, Dundy and Hitchcock Counties. **$432,000.** Flora Eng. Co., 1717 E. Colfax Ave., Denver, Colo., engr.

N. Y., Idlewild—At Office Chief Engineer, Port of New York Auth., H. S. Cullman chn., 111 Eighth Ave., New York, Zone 11, switch houses for runways at New York International Airport, Contr. NYA-40. Plans deposit $25.

Oregon—U. S. Eng., Pittock Block, Portland, furnishing 4 generators for McNary Dam Proj. $4,000,000-$6,000,000.

Oregon—Eastern Oregon Electric Co-operative, Inc., Pendleton, completing previously approved rural distr. lines, sys. imprvs., Weston Co. **$100,000.**

S. C., Conway—Horry Electric Co-operative, Inc., Conway, 148.57 mi. rural power lines, Horry Co. Plans deposit $25. Southern Eng. Co., 699 Spring St. N. W., Atlanta, Ga., engr.

South Dakota—West River Electric Assn., Ins., Wall, 208.32 mi. electric distr. lines, Pennington Co. **$208,000.** Brown Eng. Co., 325 K P Bldg., Des Moines, Ia., consult. engr.

Texas—Taylor Electric Co-operative, Inc., Merkel, rural transmission lines, Taylor Co. **$460,000.**

Tex., Fort Worth—Texas Telenet Sys., Inc., c/o James P. Nash, 1503 Marshall Lane. Austin, television broadcasting station. **$100,000.**

Tex., San Antonio—Texas Telent Sys., Inc., c/o James P. Nash, 1503 Marshall Lane, Austin, television broadcasting station. **$100,000.**

Washington—Bureau Reclamation, Dept. Interior, Building 1-A, Denver Federal Center, Denver, Colo., one 10,000/12,500 kva. auto transformer for Grand Coulee Left power plant, Columbia Basin Proj., Spec. 2353.

Wyoming—LINES — Sheridan-Johnson Rural Electrification Assn., Sheridan, 117.55 mi. electric distr. lines, Sheridan Co. **$117,000.** H. S. Nixon Eng. Co., W.O.W. Bldg., Omaha 2, Neb., consult. engr.

Low Bidders & Contracts Awarded

Illinois and Missouri—TOWERS—Union Electric Co. of Missouri, 315 N. 12 Blvd., St. Louis 1, Mo., 2 steel towers supported 138,000 volt capacity electric transmission lines, connecting Caholia Power Plant, Mississippi River below East St. Louis, Ill. with Shrewsbury, St. Louis Co., Mo., incl. overhead crossing of Mississippi River, distance about 12 mi. Approx. **$500,000.** Stone & Webster Eng. Corp., 90 Broad St., New York, N. Y., consult.

Ia., Mount Pleasant—City, J. P. Budde, city clk., 44x112 ft. rein.-con. boiler room and turbine room annex to municipal power plant, to C. C. Larsen & Son, 10 N. Main St., Council Bluffs, **$272,586.** Bids 8/25.

Mo., Independence—City, light plant, to Inter State Constr. Co., 3621 Troost Ave., Kansas City, Mo., **$111,000.** Black & Veatch, 4706 Bdwy., Kansas City, Mo., engrs.

N. Y., Elmira—Bureau Contracts & Accounts, Albany, Sept. 8, electrical work, installing steam turbine A. C. generator at Power House, Elmira Reformatory, from Horace Hayden, Inc., 16 Howell St., Rochester, **$112,386.**

Ohio—Toledo Edison Co., Edison Bldg., Toledo, 9 mi. transmission line from Castalia to Goodrich substation at Bellevue, **$90,000**; electrical substations, foot of Locust St., Toledo, **$100,000**; at Hessville, **$80,000**; Bellevue, **$100,000**; Pemberville, **$50,000**, own forces. Grand total $520,000. G. W. McIver, c/o owner, ch. engr.

Oklahoma—Oklahoma Electric Co-operative, Inc., Norman, 298.8 mi. rural distr. lines, Cleveland Co., to Reinhart & Donovan Co., 804 Commerce Exchange Bldg., Oklahoma City, labor **$95,272**, materials **$298,000**, total $393,272.

Washington—Bureau Reclamation, Dpt. Interior, Building 1-A, Denver Federal Center, Denver, Colo., Sept. 7, one 14,000 hp. hydraulic turbine and one oil pressure governor for Unit LS 3, Grand Coulee Power Plant, Columbia Basin Proj., Spec. 2338, from Pelton Water Wheel Co., 2929 19 St., San Francisco, Calif., **$139,155**, f.o.b. San Francisco, Calif. and Rockford, Ill.

Washington—Bonneville Power Admn., 729 N. E. Oregon St., Portland, mount 115 kv. transmission line, Mason and Ore., clearing right-of-way for Shelton-Fair-Jefferson Counties, Inv. 4309, Schedules 5 and 6, to McPhail Eng. Corp., 2904 Alaska St., Tacoma **$447,915**; Schedule 4, to F. E. Wilder, Olympia, **$117,440.**

INDUSTRIAL, COMMERCIAL & PUBLIC BUILDINGS

Proposed Construction

Colo., Colorado Springs—Nestle Co., Inc., Daniel F. Norton, pres. 155 E. 44 St., 1 and 2 story, brick, steel office bldg., between Yampa and Untah Sts., and Farragut St. and Foote Ave. **$1,600,000.**

La., Shreveport—City, City Hall, plans by Samuel G. Weiner, Neild & Somdal & Van Os & Flaxman. Commercial National Bank Bldg., hospital. **$8,000,000.**

Mo., Kansas City—Kansas City Baptist Memorial Hospital, c/o Dr. Terry E. Lilly, pres., Argyle Bldg., and Rev. C. P. Jones, secy., 1017 Grand Ave., plans by Keene & Simpson, 1005 Land Bank Bldg., 6 story, bsmnt., brick, stone, steel, rein.-con. general hospital, 66 St. and Rock Hill Rd. Over **$2,000,000.**

Mont., Helena—Permanente Cement Co., Latham Square Bldg., Oakland, Calif., cement mfg. plant. **$6,000,000.**

O., Apple Creek—State, Director Welfare, Columbus, brick, steel, concrete irregular shape patients cottage for mental hospital. $1,200,000. Garfield, Harris, Robinson & Schafer, 1740 E. 12 St., Cleveland, archts.

Tex., Houston—Wright Mfg. Co., c/o M. N. Dannenbaum, engr. and archt., 3908 Main St., factory. $2,000,000.

Wash., Seattle—U. S. Eng., 4735 E. Marginal Way, Zone 4, 8 story, bsmt., rein.-con. hospital with five quarters bldgs. $5,000,000. Plans deposit $50. Extended date. Naramore, Bain, Brady & Johason, Dexter Horton Bldg., Zone 4, archts.

Low Bidders & Contracts Awarded

Calif., Salton Sea—Atomic Energy Comm., 3109 Wilshire Blvd., Los Angeles, 2 story laboratory, twelve-1 story laboratories, lodge, administration bldg., shop and garage warehouse, fire station, etc., U. S. Govt., Salton Sea Base, $1,600,000. Plans deposit $50. Kistner, Curtis, Wright, 753 S. Figueroa St., engrs. and archts.

Colo., Denver—Veterans Admin. Munitions Bldg., Wash. 25, D. ., general contract Veterans Administration Hospital, Proj. 13,-4043, Spec. 4825, to Del E. Webb Constr. Co., 5101 San Fernando Rd. W., Los Angeles, Calif., **$8,132,706.** Bids 8/31, awarded 9/10.